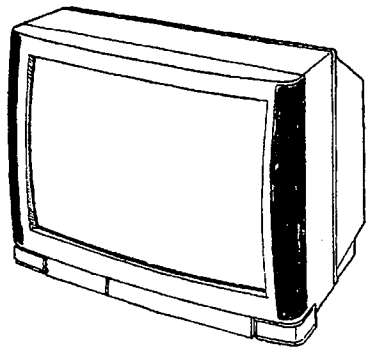
1840

ORDER NO. MTC9007390A1
B5

# Service Manual

Color Television



Model **CTM–2092S**

Chassis **ALEDP203**

**(GL8H)**

## Main Manual

The service technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this manual.

### Specifications

| | |
|---|---|
| **Power Source:** | 120 volts, 60 Hz, AC |
| **Power Consumption:** | 1.6 amps max. |
| **Antenna Terminal Impedance:** | 1–UHF/VHF 75Ω input |
| **Channel Capability:** | 155 Channel (Phase 14 Synthesizer) |
| **Off the Air:** | VHF 2~13, UHF 14~69 |
| **Cable:** | 99 Channels |
| **Video Input Jack:** | 1V p–p 75Ω, phono jack type |
| **Audio Input Jack:** | 500mV RMS, High impedance–10k |
| **Audio Out/Variable:** | 0~1V, RMS, 10k |
| **Stereo/SAP Decoder Circuit:** | Built In Circuit |
| **Stereo Output Power:** | 2w x 2w |
| **Comb Filter:** | Separates video from chroma |
| **Noise Reduction:** | Reduces interference caused by chroma mixing with horizontal lines |
| **S–VHS Input Terminal:** | Separate Y (video) and C (chroma) signals |
| **Remote Control:** | Infra–red system EUR641156 |
| **Picture Tube:** | 20" diagonal<br>90 degree deflection<br>A51ADY02X |
| **Anode Voltage:** | 29kV max. (zero beam)<br>27.75kV ±1.25kV |
| **Dimensions:** | Height – 18" (457mm)<br>Width – 21–5/8" (549mm)<br>Depth – 18–3/4" (476mm) |
| **Weight:** | 50 lbs. (22.7kg) |

Specifications are subject to change without notice or obligation.
Dimensions and weight are approximate measurements.

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# Important Safety Notice

There are special components used in this television set which are important for safety. These parts are "BOXED" on the schematic diagram and printed in **BOLD TYPE** on the replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent X–RADIATION, shock, fire or other hazards. Do not modify the original design without the permission of manufacturer.

## Safety Precautions

### General Guidelines

An ISOLATION TRANSFORMER should always be used during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the receiver and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

When servicing observe the original lead dress, especially in the high voltage circuit. In case of a short circuit, replace every part which has overheated.

Always REPLACE PROTECTIVE DEVICES, such as fishpaper, isolation resistors and capacitors and shields after working on the receiver. Use only manufacturers recommended rating for fuses, circuit breakers, etc.

High potentials are present when this set is operating. Operation of the set without the rear cover involves the danger of electric shock from the set's power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high–voltage equipment.

Extreme care should be used in HANDLING THE PICTURE TUBE. Rough handling may cause it to implode due to atmospheric pressure (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure in removal or installation. When handling, use safety goggles and heavy gloves for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from ground to anode with a well insulated piece of wire.

Avoid prolonged exposure at close range to unshielded areas of the picture tube. Possible danger of personal injury from unnecessary exposure to X–ray radiation may result.

The TEST PICTURE TUBE used for servicing the chassis at the bench should incorporate a safety glass and magnetic shield. The safety glass affords shielding from the tube viewing area against X–ray radiation as well as implosion protection. The magnetic shield limits X–ray radiation around the bell of the picture tube in addition to restricting magnetic effects. When using a picture tube test jig for service, ensure that jig is capable of handling 31kV without causing X–radiation.

BEFORE RETURNING A SERVICED RECEIVER **(of any type)** TO THE OWNER, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.

### Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and each exposed metallic part such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. When the exposed metal does not have a return path to the chassis, the reading must be infinite.

### Leakage Current Hot Check (See Figure)

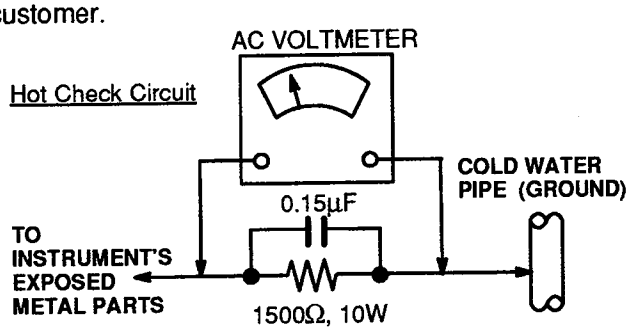
Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15µF capacitor between each exposed metallic part and ground. Use an earth ground, for example a water pipe.

Using an AC voltmeter with 1000 ohms/volt or more sensitivity, measure the potential across the resistor.

Move the resistor connection to each exposed metallic part and measure the voltage present.

Check that any potential does not exceed 0.75 volt RMS. A leakage current tester (Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above hot check, in which case any current measure must not exceed 1/2 milliamp. In case any measurement is out of the limits specified, there is a possibility of a shock hazard and the set must be repaired and rechecked before it is returned to the customer.




### X–Radiation

WARNING: The potential source of X–radiation in TV sets is the High Voltage section and the picture tube.

NOTE: It is important to use an accurate, periodically calibrated high voltage meter.

Adjust BRIGHTNESS, PICTURE, SHARPNESS and COLOR controls to minimum.

Measure the High Voltage. The high voltage meter should indicate 27.75kV ±1.25kV. If the upper meter indication is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

### Horizontal Osc. Disable Circuit Test

This test must be made as a final check before the set is returned to the customer. See HORIZONTAL OSC. DISABLE CIRCUIT PROCEDURE CHECK in this manual.

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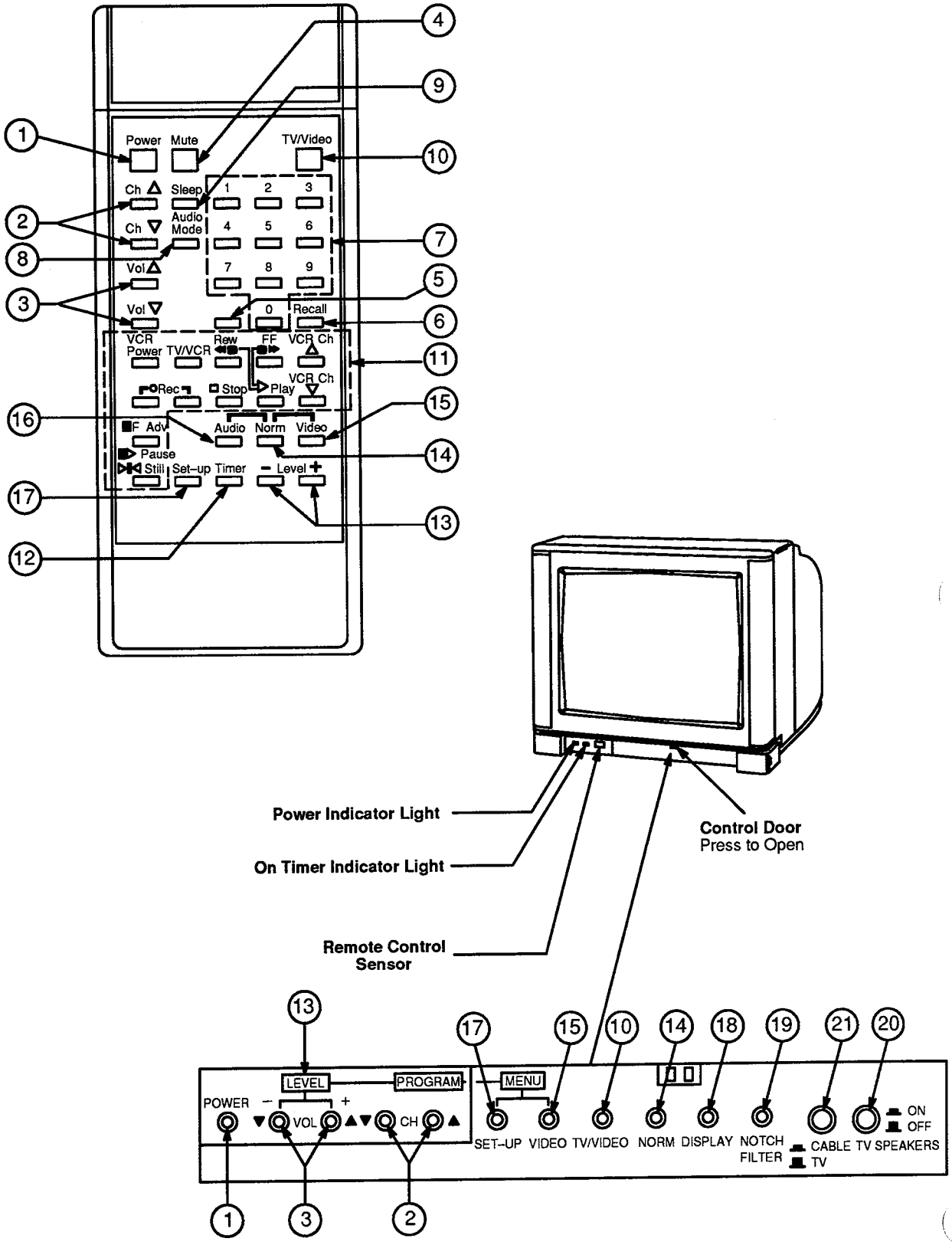
# Location of Controls



# Quick Reference Control Operation

(1) **Power Button** – Push this button to turn the Receiver ON. Push again to turn OFF.

(2) **Channel Buttons** – Push CHANNEL (CH) ▲ button to select the next higher programmed channel. Push CHANNEL (CH) ▼ button to select the next lower programmed channel.

(3) **Volume Buttons** – Push VOLUME (VOL) ▲ button to increase sound level. Push VOLUME (VOL) ▼ button to decrease sound level.

(4) **Mute Button** – Push MUTE button to mute sound. A second press will return sound to its previous level.

(5) **Last Channel Viewed Feature** – Alternately switches between last two channels selected.

(6) **Recall Button** – Reviews status of Audio Mode, channel number and sleep timer (if set).

(7) **Direct Channel Entry Keyboard** – 0 thru 9 Buttons.

(8) **Audio Mode Button** – Push to select Stereo, SAP or Mono Mode of operation.

(9) **Sleep Timer Button** – Push the SLEEP button to automatically turn Receiver OFF in 30, 60 or 90 minutes.

(10) **TV/Video Button** – Push button to select TV or Video Input Mode of operation.

(11) **VCR Function Keys (Non Programmable)**
- Preprogrammed to operate selected VCRs.

(12) **Timer Button** – Push to display ON Timer Menu. Used to turn the Receiver on at a predetermined time and channel.

(13) **Level (–) and (+) Buttons** – Push to adjust either Audio, Video or Set–Up Menus, when displayed.

(14) **Normalize Button** – Push the NORMALIZE (NORM) button while an Audio or Video Menu is displayed and the Receiver will automatically reset the adjustments to a normal level.

(15) **Video Button** – Push the VIDEO button to display a Video Adjustment Menu. Use to adjust Brightness, Picture, Sharpness, Color and Tint.

(16) **Audio Button** – Push the AUDIO button to display an Audio Adjustment Menu. Use to adjust Bass, Treble and Balance.

(17) **Set–up Button** – Push SET–UP button to display SET–UP Menus:
- Eliminate STEREO/SAP/MONO display
- Set clock
- Initiate Auto Channel programming
- Add/Erase channels from program memory

(18) **Display Button** – Push to begin review status of On–Screen Display Menus.

(19) **Notch Filter Button** – Press NOTCH FILTER button to view status of feature. Press again to activate or defeat feature. NOTCH FILTER is used to reduce cross color interference.

(20) **TV Speaker Switch** – Use this switch to turn internal speakers ON or OFF when connecting an Audio Amplifier.

(21) **TV/Cable Switch** – This two position switch selects the proper tuning system for the type of broadcast transmission connected to Antenna Input.

# Control Operation

Make sure: TV/CABLE push switch is set correctly for the TV signal system you have.
TV/VIDEO button is in TV position. See TV/VIDEO.

This Receiver has many on–screen displays which will enhance its operation. Most Menu and Function displays will be on–screen 4 or 5 seconds, then go off. To get a display back, press button that originally put that display on–screen.

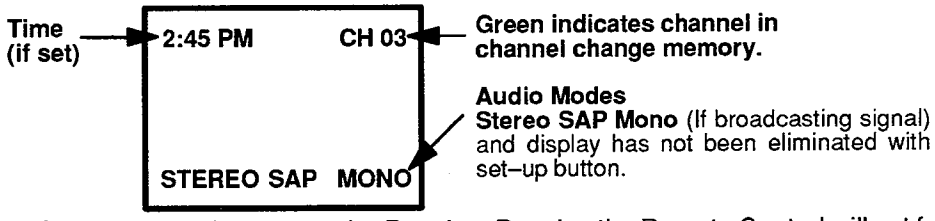
## Power Button (1)

Press POWER button on Receiver or Remote Control to turn Receiver ON or OFF. When Receiver is first turned on, a channel number will display. If channel is broadcasting Stereo or SAP (second audio program), the AUDIO MODES will display (Stereo Models ONLY). The clock time will display only if the TIME is set.

- When the Receiver is turned on, channel displayed will be the last channel viewed.
- When the Receiver is turned on, sound level will be the same as when Receiver was turned off.

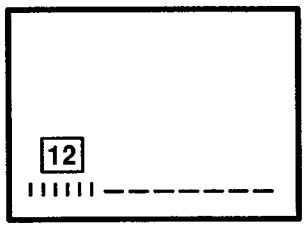
## Channel Buttons (2)

Press CHANNEL ▼ (next lower channel) or CHANNEL ▲ (next higher channel) on Receiver or Remote Control to select channels in Channel Change Memory. Hold button in until desired channel is reached. Channel number will display on–screen. If channel selected is broadcasting in Stereo or SAP, the AUDIO MODES will display. If clock is set, the Time will display. (See AUDIO MODE BUTTON).


Time
(if set)
2:45 PM
CH 03
Green indicates channel in channel change memory.
Audio Modes
Stereo SAP Mono (If broadcasting signal) and display has not been eliminated with set–up button.
STEREO SAP MONO

- If the CHANNEL ▲ or CHANNEL ▼ buttons on the Receiver Panel or the Remote Control will not function, it is an indication that all channels but one have been erased from memory. To operate tuning, press SET–UP button to display Program Video Menu with arrow indicating CH. As long as menu is on–screen the channel scan buttons will work.
- When the TV Receiver has been unplugged from the power line for a long time and then turned on, it may scan all channels when the CHANNEL ▲ or CHANNEL ▼ button is pressed. In that case, all channels have been erased from Channel Scan memory. If only a few channels are desired when changing channels, ADD them to memory. Only the added channels will now tune during channel ▼/▲ operation.

## Volume Buttons (3)



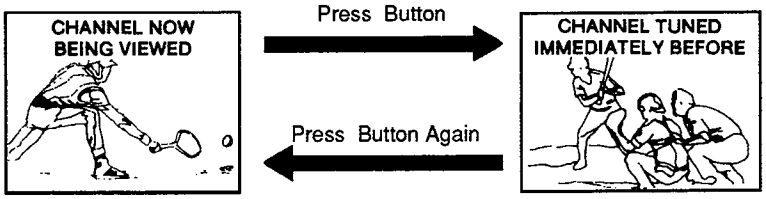

Press VOLUME ▲(increases volume) or VOLUME ▼(decreases volume) button on Receiver or Remote Control. Observe row of bars and number on–screen. Hold VOLUME ▲ or VOLUME ▼ button until desired sound level is reached. Row of bars and number indicates volume setting and will increase or decrease with volume level.

**NOTE:** The VOLUME buttons located on Receiver front panel are dual function and will act as LEVEL buttons when certain menus are displayed. You will be instructed on the use of the LEVEL (+) and LEVEL (–) buttons when the different menus are used for a particular feature.

## Mute Button (4)

Press MUTE button on Remote Control to mute sound immediately. "MUTE" will display for a few seconds. Press again and sound will be restored to same level as before muting. Display of volume level adjustment appears.

## Last Channel Viewed Feature Button (5)



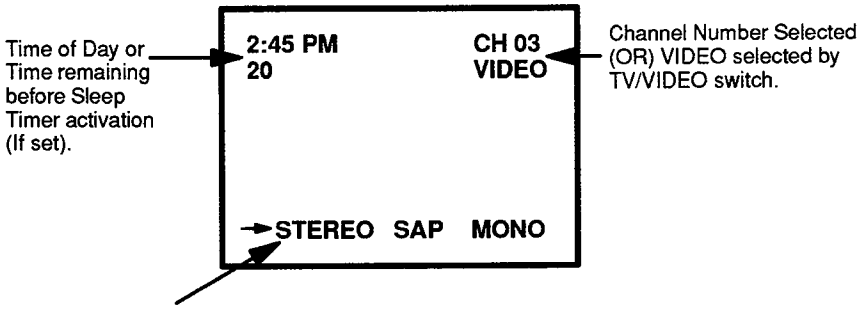

This feature allows the viewer to switch back to the last channel tuned immediately before the channel now being viewed. Repeated operation of this button switches the Receiver back and forth between the last two channels tuned. The switching is practically instantaneous without passing through any intermediate channels and no on–screen display of channel number, time, etc., is activated. This allows the viewer to monitor two programs at the same time without entering the actual channel numbers each time and without waiting for on–screen display to switch off.

The last channel viewed feature will not operate:

- If the same channel number is entered twice in succession.
- Immediately after switching TV/CABLE switch.
- When operating in VIDEO mode.

## Recall Button (6)

A press of this button will display the following:


Time of Day or Time remaining before Sleep Timer activation (If set).
2:45 PM
20
CH 03
VIDEO
Channel Number Selected (OR) VIDEO selected by TV/VIDEO switch.
STEREO SAP MONO
STEREO/SAP/MONO menu (Stereo Models Only).

- Cursor indicates mode you have selected.
- STEREO or SAP in red letters indicates that audio signal is available.
- This menu doesn't appear in VIDEO mode.

## Direct Channel Entry Keyboard (7)

**Channel Selection – Using 0–9 Digits on Remote Control**

**For Channels 1 through 9** – Enter a single number for a channel change. Example: For channel 8, press the digit 8, for channel 3, press the digit 3. After 2–3 seconds, the channel changes. (For faster channel change, enter 0 first.)

**For Channels 10 through 99** – Two numbers must be entered to complete a channel change. Example: For channel 25 press the digit 2, then the digit 5. When the first button is pressed, the tens digit will appear. The second entry displays the units digit and the channel changes.

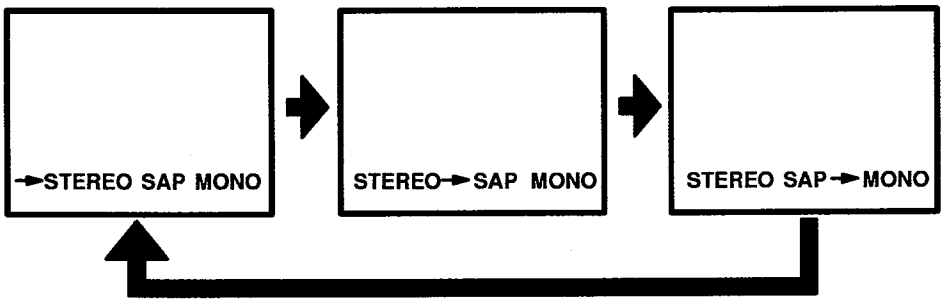
- If the second entry is not made within 2 seconds following the first entry, the channel will change to the number of the first digit entered. Example: for channel 25, the 2 digit is pressed first and if the 5 digit is not pressed within 2–3 seconds, the set changes to channel 2.
- If an invalid channel number is entered (Example: 01 or any number above 69 in the TV position of TV/CABLE push switch) the set remains on the existing channel.
- The channel being viewed can be determined anytime by pressing the RECALL button.
- If the channel selected is broadcasting STEREO or SAP the AUDIO modes will display when desired (See SET–UP menu button, "Eliminate Stereo/SAP/Mono Display").

## Audio Mode Button (8)

A press of this button will display Audio Menu. Audio options broadcast to the viewer are in Red.

- STEREO – Dual Audio channel reception.
- SAP – Second Audio program (bilingual programming, in house paging, etc.)
- MONO – Single Audio channel reception.

To change Audio Modes, press AUDIO MODE button until cursor indicates the Audio Mode desired.




**NOTE:**

1. If STEREO or SAP signals are not broadcast, Receiver will automatically default to MONO reception.
2. If STEREO signal is weak, it is recommended to switch to MONO mode.

## Sleep Button (9)

This function allows the viewer to automatically turn the set off after a predetermined time lapse of 30, 60 or 90 minutes with the Remote Control.

1. A press of the SLEEP button located on the Remote Control, will set the Sleep Timer function for 30 minutes and display the clock in the upper left corner. **30**
2. Press the SLEEP button two times and the Sleep Timer function will be set for 60 minutes. **60**
3. Press the SLEEP button three times and Sleep Timer function will be set for 90 minutes. **90**
4. To deactivate the Sleep Timer, press SLEEP button continuously until the clock reads 0, or turn the set off using the POWER button. **0**
5. Clock will flash 3, 2 and 1 to indicate the last remaining minutes prior to turn off. This allows the viewer to reset or deactivate this function before the receiver shuts off.

**NOTE:** After Sleep Timer is set, use the RECALL button to find time that remains prior to automatic turn off.

A press of the SLEEP button while Sleep Timer function is active will reset the timer clock to the next higher 30 minute interval.

## TV/Video Switch (10)

Each press of TV/VIDEO button on Remote Control or Receiver, alternately switches between TV and Video Modes.

- TV (CH and channel number display on–screen) normal TV operation.
- VIDEO (VIDEO will display on–screen) used when optional accessory video equipment (such as VCR, VIDEO DISC player, etc.) is connected to the INPUT TERMINALS on back of set.

Connect the optional accessory equipment to terminals on back of Receiver. If your optional equipment is monaural (has only one audio channel) use an optional audio "Y–CONNECTOR" so both channels in the set will operate.

| Terminal ( RCA ) | Level | Impedance |
|---|---|---|
| INPUT – VIDEO | 1V p–p | 75 ohms |
| INPUT – AUDIO | 500mV rms for max output | More than 10K |

## VCR Function Keys (11)

These keys have been factory pre–set to work with selected VCRs .

## Timer Button (12)

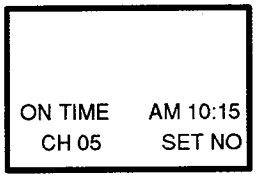
Press TIMER button on Remote Control to view status of the ON TIMER menu. The ON TIMER menu may be programmed to turn the Receiver on at any time within a 24 hour period and will be tuned to a predetermined channel.

**IMPORTANT NOTE:** TIME OF DAY MUST FIRST BE SET BEFORE THIS FEATURE CAN BE USED. When Receiver is turned on or when changing channels, if there is not a time display on–screen, the time is not set.

### To Program On Timer Menu:

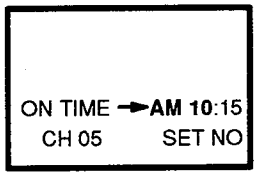
1. Press TIMER button located on Remote Control to display ON TIMER menu.

1.



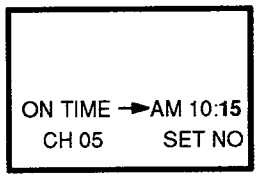

2. Repeatedly pressing TIMER button will advance cursor (→) to ON TIME hours position and it will display in Red. Use Level (+) or (–) buttons to set hours AM or PM.

2.



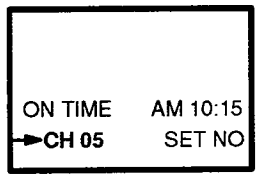

3. A press of the TIMER button again advances to MINUTES position and it will display in Red. Set minutes with the use of LEVEL (+) or (–) button.

3.



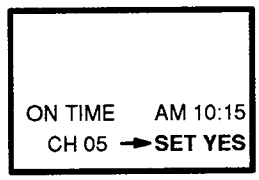

4. To set CH (channel): Press TIMER button to advance cursor to CH position. It will display in Red. Press LEVEL (+) or (–) on Remote Control until the desired channel number you want Receiver tuned to, when turning on. (Only programmed channels are available.)

4.




5. To activate SET: Press TIMER button to advance cursor to SET position. Each press of LEVEL (+) or (–) button selects YES or NO. Select YES if you want to activate the ON TIMER feature. If not, select NO.

5.




**Special Conditions Affecting ON/OFF Timer**

- When ON TIME program is set "YES" and Receiver is manually turned on prior to selected ON TIME, the Receiver will automatically tune to the channel selected by ON TIME setting at hour and minute selected.
- ON TIMER feature must be reset each time it is desired.
- When the Receiver is turned on by the ON TIMER feature, the Receiver will shut OFF automatically after 90 minutes unless a function key is activated.

## Level (–) and (+) Button (13)

The LEVEL buttons are used in conjunction with the Audio, Video, Set–up or Timer buttons. Once a display is On–Screen the LEVEL (–) and (+) buttons are used to make the desired level change or aids the operation of a function selected.

## Normalize (Norm) Button (14)

Press the NORMALIZE (NORM) button while an Audio or Video menu is displayed On–Screen. The Receiver will automatically set feature adjustments to a normal level for a good sound or picture quality.

## Program Video Menu Button (15)

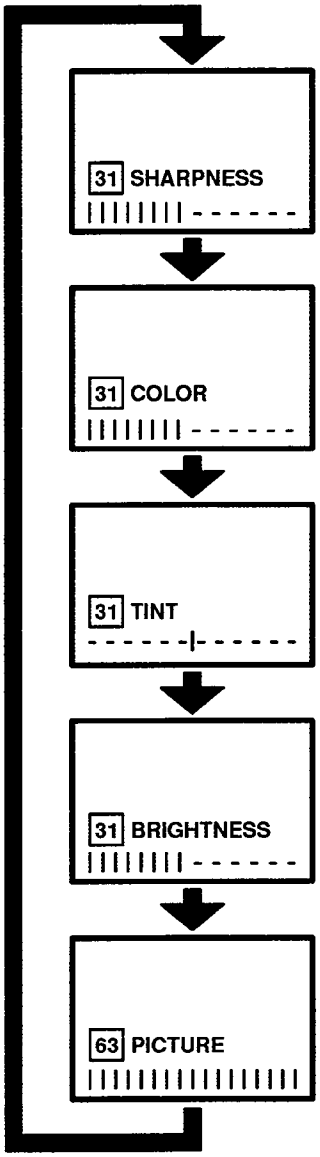
- SHARPNESS – use to adjust for best clarity of outline detail and reduce effects of noise interference in picture.
- COLOR – use to adjust color intensity.
- TINT – use to adjust natural flesh tone.
- BRIGHTNESS – use to adjust so that dark areas of picture just become black for a crisp detail.
- PICTURE – use to adjust whitest parts of picture to your preference.

### To Adjust

1. Press VIDEO button on Receiver or Remote Control to display the last PROGRAM VIDEO MENU function operated.
2. Each additional press of the VIDEO button will select a different video function.
3. Press or Hold LEVEL (+) or (–) button on Receiver or Remote Control to adjust function. Adjustment scale and setting indicator number will display on screen. Use to establish a desired level.

**NOTE:** Press – adjustment is made in small increments with each press.
Hold – adjustment is continuous until button is released.

4. Adjust each function to your own preference or you may select a factory set level by pressing NORM (normalize) button on Remote Control while any of the functions of PROGRAM VIDEO MENUS are displayed.

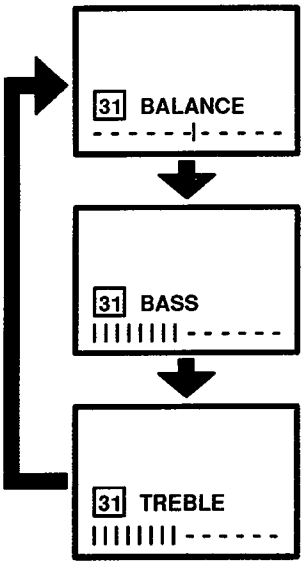



## Audio Button (16)

- BALANCE – use to adjust left to right sound output.
- BASS – use to adjust LOW PITCH sound.
- TREBLE – use to adjust HIGH PITCH sound.

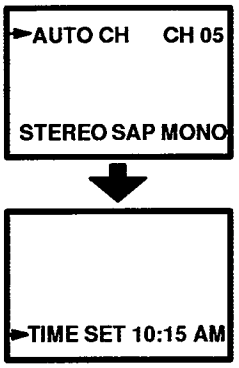
### To Adjust

1. Press AUDIO button on Remote Control to display the AUDIO menu function last operated.
2. Each additional press of the AUDIO button will select a different Audio function.
3. Press or hold LEVEL (+) or (–) button on Receiver or Remote Control to adjust desired function. Adjustment scale and setting indicator number will display on screen. Use to establish desired level.
4. Adjust each function to your own preference or you may select a factory set level by pressing NORM (normalize) button on Remote Control while PROGRAM AUDIO MENU is displayed.



## Program Set–up Menu Button ⑰

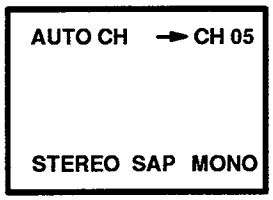
- A press of the SET–UP button located on either the Remote Control or Receiver will display one of two Program Set–Up Menus.




The PROGRAM SET–UP MENUS are used as an On–Screen aid to help set a number of Receiver operating features. With the use of these menus, you can ADD or ERASE channels from program channel memory, initiate AUTO CHANNEL Programming, SET CLOCK, hours and minutes and ELIMINATE STEREO/SAP/MONO display when changing channels.

### Add/Erase Channels From Memory

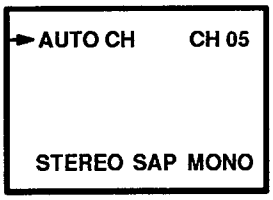
- Channels added to memory will tune when using CHANNEL ▲ or CHANNEL ▼ button.
- Channels Erased from memory will be skipped when using CHANNEL ▲ or CHANNEL ▼ buttons.
- Channels not programmed into memory can be viewed by changing channels while SET–UP menu is displayed or by using direct channel entry with Remote Control.




1. Press SET–UP button on Receiver. A PROGRAM SET–UP MENU displays on–screen.
2. Press SET–UP button repeatedly until the arrow points at channel number display. **NOTE:** A channel displayed in Yellow indicates the channel is not in channel program memory. A channel displayed in Green indicates the channel is in channel program memory.
3. While the menu is on–screen, select a preferred channel with CHANNEL ▲ or CHANNEL ▼ button OR use numbers on Remote Control by direct channel entry. (Refer to Direct Channel Entry Keyboard.)
4. To ADD a channel when channel number is displayed in Yellow. Press LEVEL (+) on the Receiver or Remote Control.
5. To ERASE a channel when channel number is displayed in Green. Press LEVEL (–) on the Receiver or Remote Control.

### Auto Channel Programming

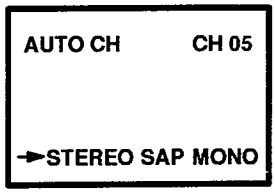
The Receiver automatically scans through all TV channels in the TV Broadcast System or CABLE Transmission System. It will add to channel program memory any channel with a signal present. The channel numbers will be displayed in Green. Make sure TV/CABLE push switch is in correct position for the TV signal system you have.




1. Press SET–UP button once to display the PROGRAM MENU, continue pressing the SET–UP button until the arrow points to AUTO CH.
2. Press LEVEL (+). Auto channel programming feature starts. To defeat once started, press ANY OTHER button.

## Eliminate Stereo, SAP, Mono Display

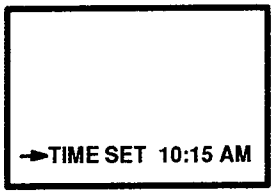
- When a channel is broadcasting audio in Stereo or SAP, a display of Audio Modes (STEREO/SAP/MONO) appears on the screen. If this feature becomes annoying when changing channels the display can be eliminated.




1. Press SET–UP button once to display the PROGRAM SET–UP MENU. Continue pressing button repeatedly until the arrow points to the Audio Modes (STEREO/SAP/MONO) display.
2. Press LEVEL (–). The STEREO/SAP/MONO display will change to Red dashes. This indicates it has been eliminated from on–screen display.

**NOTE:** To return the Audio Modes (STEREO/SAP/MONO) display, follow Step 1, then press LEVEL (+) button.

### Setting Clock Time




1. Press SET–UP button repeatedly until TIME SET menu appears.
2. CLOCK HOURS position is in Red. Press LEVEL (+) to advance hours. LEVEL (–) will reverse hours. Notice the AM or PM in hours display and set it accordingly.
3. Press SET–UP button again. CLOCK MINUTES position is in Red. Press LEVEL (+) to advance minutes. LEVEL (–) will reverse minutes.

## Display Button (18)

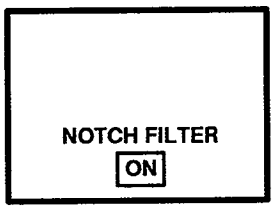
This feature continuously reviews the status of all On–Screen Displays listed below.

A. Volume Display
B. Last Adjusted Audio or Video Mode Menus
C. Set–Up Menus
D. On Timer Menu
E. Recall Menu

1. Press DISPLAY button on Receiver. The display review starts.
2. Press any other function button on Receiver; display review stops.

## Notch Filter Button (19)

This switch can be used to reduce some cross color interference that can be caused by chroma mixing with video and being apparent on horizontal lines. This interference is not always readily apparent so in most cases Notch Filter should be left in OFF mode unless you can see some improvement in picture when you turn it ON.




1. Press NOTCH FILTER button on Receiver to display NOTCH FILTER menu.
2. Press again to activate or deactivate feature.

## TV Speaker Switch (20)

The TV SPEAKER (two position, ON/OFF) slide switch will turn the internal receiver speakers ON or OFF. This switch is used when making connections to external speaker terminals or to Audio Amp jacks. Refer to OPTIONAL EQUIPMENT CONNECTION AND OPERATION DETAILS for further information.

**NOTE:** TV SPEAKER switch must be in ON position in order to have internal speakers operating.

## TV/Cable Push Switch (21)

**TV** – If you are not connected to a cable TV system, set the TV/CABLE push switch to TV position. You can now receive off the air TV VHF and UHF channels 2 thru 69 through the use of an indoor or optional outdoor antenna.

**CATV (CABLE)** – When your TV is connected to a cable TV system and you are not using a cable company converter box, set the TV/CABLE push switch to CABLE position. You can now receive cable television channels 1 thru 99.

- Some cable TV systems encode (scramble) program material on specific channels. This Receiver cannot reproduce acceptable pictures from these channels unless a cable company supplied decoder is used.
- Certain cable TV systems severely offset some channels to reduce interference. It will be necessary to use the cable company supplied converter to receive these specific channels.

| BAND | USA/CAN |
|---|---|
| VHF | 12 |
| UHF | 56 |
| CABLE (Mid–Band) | 15 |
| CABLE (Super Band) | 14 |
| CABLE (Hyper Band) | 28 |
| CABLE (Ultra Band) | 30 |
| **TOTAL CHANNELS** | **155** |

# Disassembly For Service

## Back Cover

1. Remove all 8 screws indicated by ◄ on back of set.

## A–Board

1. Push securing plastic clip and slide chassis completely out.
   **NOTE:** Some tie–wraps securing wire dressings may have to be unfastened for chassis removal.
2. Stand chassis upright using right side of chassis bracket as base. Now underside is completely accessible for component removal.

## C–Board

1. Plugs into socket on CRT neck.

## E–Board

1. Plugs into main chassis A1 and A2 sockets.

## X–Board

1. Plugs into main chassis A3 and A4 sockets.

## R–Board

1. Secured to cabinet front by plastic clips. Use small screwdriver to gently lift clips and pull board out.

## L–Board

1. Secured to cabinet front by plastic clips. Use small screwdriver to gently lift clips and pull board out.

## F–Board

Fastened to X–Board by plastic stand–offs.

## Audio Transformer

1. Held in place on plastic mounting bracket with 1 screw.
2. Mounting bracket and transformer may be removed from cabinet as unit. Remove hot melt and gently lift plastic tab and slide unit out of cabinet.

# Disassembly for CRT Replacement

1. Discharge CRT as instructed in Safety Precautions.
2. Disconnect yoke plug, degaussing coil plug from main board and CRT 2nd anode button.
3. Remove C–Board from CRT base and unplug black wire (CRT dag ground) from board.
4. Slide main chassis assembly completely out. Remove with CRT Board and audio transformer (when applicable).

## CRT Replacement

1. Perform DISASSEMBLY FOR CRT REPLACEMENT procedure.
2. Insure CRT H.V. anode button is discharged before handling CRT. See SAFETY PRECAUTIONS on handling the picture tube.
3. Remove components on CRT neck and place cabinet face down on a soft pad.
4. Remove CRT mounting bolts from each corner and remove CRT with degaussing coil and dag ground braid attached.
5. Note original location and mounting of degaussing coil and dag ground assembly to insure proper re–installation on the replacement CRT.
6. To remove degaussing coil cut 4 plastic ties that retain degaussing coil to CRT mounting ears. Four replacement ties are required when degaussing coil is mounted in replacement CRT.
7. Remove dag ground braid by unhooking coil spring from lower left CRT bracket and remove braid loop from upper right corner bracket.
8. Mount dag ground braid and degaussing coil on replacement CRT. Mount replacement CRT in cabinet.

# Service Notes

**IMPORTANT: To protect against possible damage to solid state devices due to arcing or static discharge, make certain all ground wires and CRT DAG wire are securely connected.**

**CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing to avoid damage to test equipment or chassis. Connect test equipment to correct ground ( ⏚ ) or ( ⏚ ) when servicing or incorrect readings will occur.**

**WARNING: This Receiver has been designed to meet or exceed applicable safety and X–radiation protection as specified by government agencies and independent testing laboratories.**

**To maintain original product safety design standards relative to X–radiation and shock and fire hazard, the parts shown in the "BOXED" areas of the schematic must be replaced with identical replacement parts. Order parts from the manufacturer's parts center using numbers shown in this service manual or give complete chassis number and part reference number.**

**For optimum performance and reliability, all other parts should be replaced with components having identical specifications.**

## Horiz Osc Disable Circuit

This chassis employs a special circuit to protect against excessive high voltage and beam current. If for any reason the high voltage and beam current exceed a predetermined amount, this circuit operates and detunes the horizontal oscillator. This limits high voltage.

The over–voltage protection circuit is not adjustable. However, if components in the "BOXED" areas of the schematic in either the horizontal sweep system or the over–voltage protection circuit itself are changed the operation of the circuit should be checked using the following procedure.

Equipment needed to check disable circuit:

1. Accurate voltmeter (0 – 200V scale)
2. High Voltage Meter (0 – 40kV)
3. Variac and Isolation Transformer

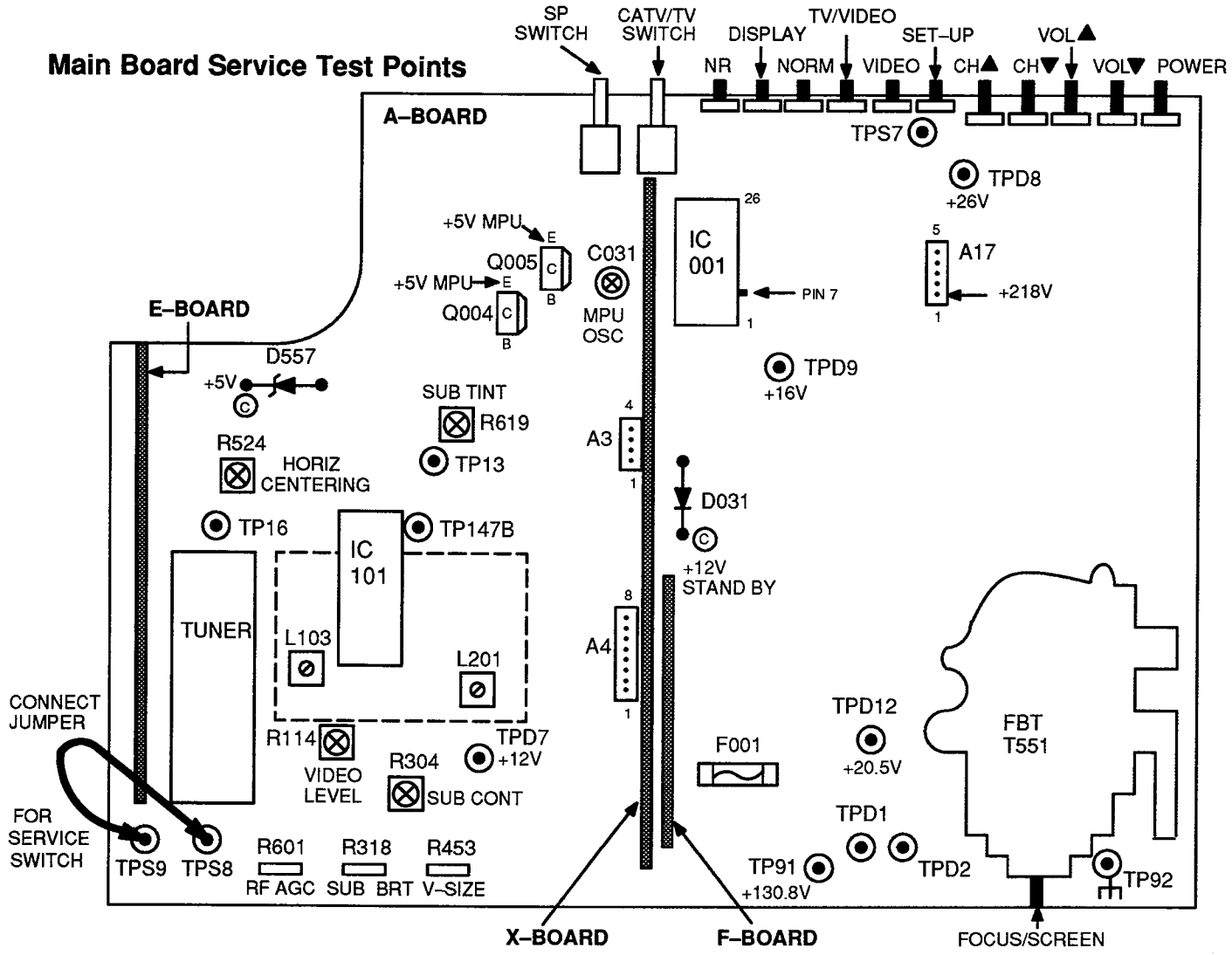
**Procedure**

1. Tune in a station to verify horizontal is in sync.
2. Obtain Monoscope pattern.
3. Connect voltmeter (+) to TPD2 and (–) to TPD1. Normalize VIDEO control menu. Adjust BRITE to (0) and PICTURE for 0.9 volt reading on voltmeter.
4. Turn Receiver OFF. Connect jumper across R802 (180Ω, 15W).
5. Reduce AC supply voltage to approx. 90V. Connect high voltage meter to CRT 2nd anode (H.V. button). **NOTE:** Use ( ⏚ ) ground for minus (–) lead connection of meter.
6. Turn Receiver ON. Slowly raise AC supply voltage and confirm that high voltage does not exceed 32.65kV (33kV Canadian Models) when horizontal just begins to pull out of sync and sound mutes. If high voltage is not within the specified limit, the cause must be determined before the Receiver is returned to the customer. (SEE NEW CIRCUIT SECTION).

# Service Adjustment Procedures

**ALL SERVICE CONTROLS ARE FACTORY PRESET AND SHOULD NOT REQUIRE ADJUSTMENT UNLESS CONTROL AND/OR ASSOCIATED COMPONENTS ARE REPLACED.**
**NOTE: CONNECT MINUS LEAD OF VOLTMETER TO CORRECT GROUND FOR CIRCUIT BEING CHECKED. WHEN NECESSARY TO USE A LINE OPERATED GROUND, THE GROUND INDICATION (⏚) WILL BE INDICATED. FOR THIS GROUND, USE TP92. FOR ALL OTHER CIRCUITS, CONNECT MINUS LEAD OF VOLTMETER TO LINE ISOLATED GROUND (⏚) IF SHIELD, IC451 HEAT SINK OR TPB3.**

## Main Board Service Test Points




### 130.8V B+ Voltage Confirmation

1. Set BRIGHT, PICTURE and COLOR of Video Menu to Minimum.
2. Connect a DVM between TP91 and ground (⏚) TP92.
3. Confirm that B+ voltage is 130.8V ±1V. This voltage supplies B+ to Horizontal & Flyback circuits.

### Source Voltage Chart

120V AC line input. BRIGHT and PICTURE of Video Menu to Minimum. Use isolated ground (⏚) for minus lead of DVM. These voltages are supplied by flyback transformer T551.

| | |
|---|---|
| TPD7 | +12.0V ±1V |
| TPD9 | +16.5V ±2V |
| TPD8 | +26.0V ±2V |
| Plug A17 (Pin 1) | +210V ±15V |

### +5V Source

Cathode D557 (Tuner BP)
Emitter Q004 (MPU, VDD ports– IC001)
Emitter Q005 (MPU, Function buttons, Remote Receiver)

### +10V Standby B+

Cathode D031 (On–Off relay, Timer L.E.D., IC101 Pin 9–Horiz Osc, Q004 – +5V regulator).

### High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Confirm B+ 130.8V is within limit.
3. Using a calibrated high voltage meter confirm that High Voltage is 27.75 ±1.25kV.

## RF AGC Delay R106

Adjust only if overloading on strong signal or busy background (snow) is present on moderate strength signals.

1. Adjust RF AGC control R106 until snow appears in picture, then adjust control until snow is eliminated.
2. Check all channels for optimum setting.

## AFC Field Adjustment L103

1. Set TV/CABLE switch to TV position.
2. Defeat AFC by applying 21kΩ jumper from TPS7 to ground ( ⏚ ).
3. Connect a digital voltmeter to AFC test point TP16. (Connect + lead to ground).
4. Check all active High Band channels 7~13 for AFC voltage range. Select channel with AFC voltage in approximate center of voltage range.
5. Adjust L103 for 4.5V ±0.5V at TP16.
6. Remove jumper in Step 2. Check all active channels for proper AFC correction. Touch up L103 if required.

**NOTE:** Do not use TV/CABLE channel with offset carriers for adjustment or in determination of low and high range of AFC voltage.

## Sound Alignment L201

1. Select active TV channel.
2. Attenuate signal (loosely couple antenna lead or use RF attenuator pad) for noisy sound.
   - Adjust L201 for maximum sound. Signal to noise ratio is best when L201 is peaked.
3. Connect antenna or remove RF attenuator for strong signal.

## Sub–Brightness Control R318

Adjustment of this control is important for getting proper operation of brightness and picture controls. This adjustment must be made after Sub–Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN control after Sub–Brightness is set.

### Preparation

Connect a color bar signal with 100 IRE white and 7.5 IRE black. Operate television for a minimum of 10 minutes prior to the adjustment.

### Procedure

1. Normalize the Video Menu Controls.
2. Adjust COLOR to Minimum.
3. Increase SUB–BRIGHTNESS control R318 so black bar starts to look grey. Then decrease SUB–BRIGHTNESS to the point where grey turns to black.
4. Adjust COLOR for normal viewing and check all active channels for good brightness level.

## Video Level R114

**CAUTION: Do not adjust** unless control has been replaced or control was accidentally misadjusted.

### Preparation

Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.

### Procedure

1. Connect oscilloscope to Plug A4 Pin 7 Use cold ground for scope connection. Set scope at Horizontal time base.
2. Adjust R114 for 1 Volt p–p from sync tip to white level. See detail.
3. Set Sub–Contrast adjustment.

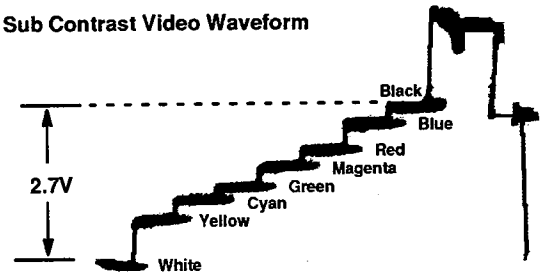
## Sub Contrast R304

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT board or the CRT is replaced.

### Preparation

- Obtain a pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black. **NOTE:** The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to your pattern used.

1. Connect signal (pattern as described above).
2. Connect oscilloscope to TP13. Set scope horizontal time base to 20µs (horizontal).
3. Connect a 4.7K ohm jumper from TPD7 to TPD1.
4. Set Video Menu controls to be Normalized.



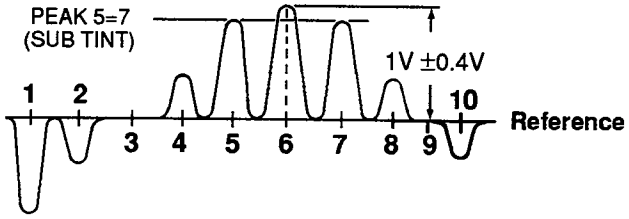

5. Adjust SUB–CONTRAST control R304 for 2.7V from white level to black level on video waveform (see video waveform detail).
6. Remove jumper (Step 3).

## Comb Filter Adjustment – R335 and L304 (F–Board)

1. Connect an NTSC color bar generator (not rainbow generator) to antenna or select a TV channel with a color program.
2. Connect an oscilloscope to TP13 on A–Board. (C25 on CRT Board).
3. Set oscilloscope sweep rate to view color burst signal on horizontal sync pulse.
4. Set BALANCE control R335 fully clockwise. Burst amplitude should increase making it more visible.
5. Adjust phase coil L304 on A–Board for minimum burst amplitude.
6. Re–adjust BALANCE control R335 for minimum burst amplitude.

## Color Adjustment R619

1. Apply rainbow color bar signal.
2. Set customer controls
   - Normalize VIDEO menu. Adjust BRITE to Minimum (0). Adjust PICTURE until raster just appears dark.
   - Connect 4.7K resistor jumper between TPD7 (+12V) and TPD1.
3. Connect Oscilloscope to TP47B.
4. Adjust SUB TINT (R619) so peak of color bar 6 equals 1V and peaks of color bars 5 and 7 are of the same magnitude as shown in detail.




## Color Temperature Adjustment (B/W Tracking)

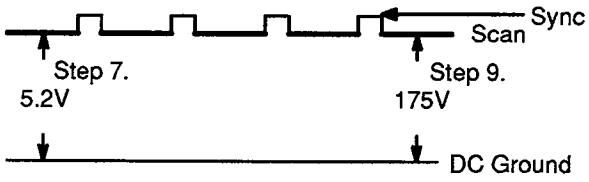
### Minor Touch–Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good grey scale and warm highlights".

- LOW LIGHT areas – adjust LOW LIGHT controls (R354, R355, R356) for grey.
- HIGH LIGHT areas – adjust DRIVE controls (R357, R358) for warm whites.

### Complete Adjustment

1. Turn Receiver ON and allow 10 minutes warm up at high brightness.
2. Select active TV channel, B/W program if available.
3. Normalize the VIDEO menu controls.
4. Adjust COLOR to Minimum.
5. On CRT board adjust COLOR LOW LIGHT controls (R354, R355, R356) and COLOR DRIVE controls (R357, R358) to midpoint.
6. Collapse vert to a horizontal line by applying jumper between TPS8 and ground (⏚) TPS9 and turn SCREEN control to Minimum (counterclockwise).
7. Connect oscilloscope to TP13. Observe waveform at Horiz. rate and adjust SUB BRIGHT (R318) to set scan of waveform 5.2V above DC ground. (Shown in detail).
8. Connect Oscilloscope to Green Cathode (KG) on CRT socket.
9. View trace at horizontal rate and adjust GREEN LOW LIGHT control (R356) to set scan of waveform 175V above DC ground.




10. Connect scope to Red Cathode (KR) and adjust its waveform scan period 175V above ground with RED LOW LIGHT control (R354).
11. Connect scope to Blue Cathode (KB) and adjust its waveform scan period 175V above ground with BLUE LOW LIGHT control (R355).
12. Increase SCREEN control (Clockwise) until a color horizontal line just appears.
13. With the other two colors LOW LIGHT controls, advance each to create a white horizontal line.
14. Remove jumper in Step 6.
15. Adjust BRITE and PICTURE to Maximum and adjust DRIVE controls for warm white.
16. Adjust BRITE and PICTURE to low level brightness and recheck for low level grey scale. Adjust LOW LIGHTS if necessary.
17. Perform SUB–BRIGHTNESS adjustment.

## Vertical Size R453

1. Turn VERTICAL SIZE control R453 CCW until top and bottom edges of raster are visible.
2. Adjust VERTICAL SIZE control CW until top and bottom of raster touch bezel edge. Advance SIZE control CW an additional 30 degrees. This will be approximately 10% overscan. Linearity adjustment is automatic with size adjustment.

## Horizontal Centering R524

1. Connect crosshatch generator to the antenna terminals.
   a. Set VIDEO menu for Normalize.
2. Set H–CENTER (R524) so center square of cross-hatch pattern is centered on CRT screen.

## Focus (Part of T551)

Adjust the FOCUS control to obtain the sharpest and clearest picture.

## MPU Reference Oscillator C031

1. Connect frequency counter from TPS1 (A3–4) to ground (⏚).

**NOTE:** Frequency counter probe capacitance should be 8PF or less.

2. Set TV/CABLE switch to TV position. Short TPS2 (IC001, Pin 7) to ground.
3. Select channel 13 and adjust trimmer capacitor C031 for 5,000KHz ±3.5Hz.

# Purity and Convergence Procedure

Adjustment should be necessary only if the CRT or deflection yoke is replaced or if someone has disturbed the setting. The complete procedure consists of:

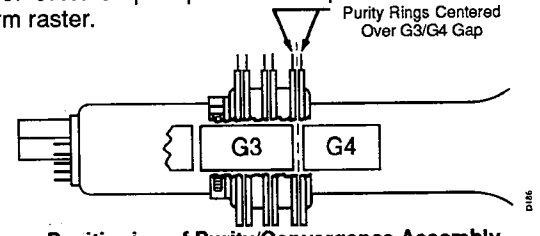
1. Initial static convergence
2. Setting purity
3. Final static convergence

## When CRT or Yoke is Replaced

Place the yoke on the CRT neck (do not tighten clamp).

Position purity/convergence assembly as shown and tighten clamp snugly. Cut wax seal on assembly and place like tabs of purity device together at 12 o'clock to reduce its magnetic field effect. Manually degauss CRT.

Turn Receiver ON and slide deflection yoke back and forth on neck of CRT. Stop at position that produces a near white, uniform raster.




**Positioning of Purity/Convergence Assembly**

## Initial Center Static Convergence

Connect dot/crosshatch generator to Receiver and tune in signal. Observe misconvergence at center of screen only.

Adjust 4 pole magnet (center rings): separate tabs and rotate device to converge blue with red.

Adjust 6 pole magnet (rear rings): separate tabs and rotate device to converge blue and red (magenta) with green. NOTE: Precise convergence at this point is not important.

## Purity Adjustment

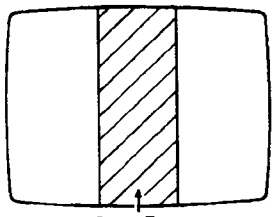
Operate the Receiver for 60 minutes with BRIGHT control at maximum to stabilize the CRT.

Degauss the Receiver fully by using an external degaussing coil.

Short TP14 to ground for blank raster. Set VIDEO MENU BRIGHT to mid position.

Turn red and blue LOW LIGHT controls fully counterclockwise to obtain a green field. Adjust DRIVE controls if green field is not obtained. Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.

Adjust the purity magnet to set the vertical green raster precisely at the center of the screen. (Shown below.)



**Green Raster**

Slowly move the deflection yoke forward and adjust for the best overall green screen.

Tighten the deflection yoke clamp screw.

Produce a blue and then red raster by LOW LIGHT controls and observe that good purity is obtained on each respective field.

Observe that uniform white raster is obtained by adjusting LOW LIGHT controls. If screen is not uniformly white, repeat above procedure.

## Final Convergence Procedure

NOTE: Before attempting convergence adjustment, vertical size, pincushion and focus adjustments must be completed. Connect a dot pattern generator to the set. The brightness level should be no higher than necessary to obtain a clear pattern.

Converge the red and blue dots at the center of the screen by rotating the 4 pole (R with B) Static Convergence Magnets.

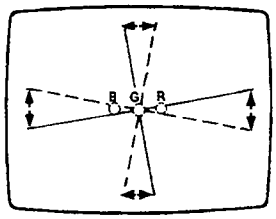
Align the converged red/blue dots with the green dots at the center of the screen by rotating the 6 pole (R/B with G) Static Convergence Magnets. Melt wax with soldering pencil to reseal magnets.

Slightly tilt (do not rotate) the deflection yoke vertically and horizontally to obtain good overall convergence.

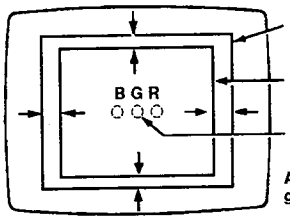
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.

Secure deflection yoke by inserting side two wedges at 3 and 7 o'clock positions.

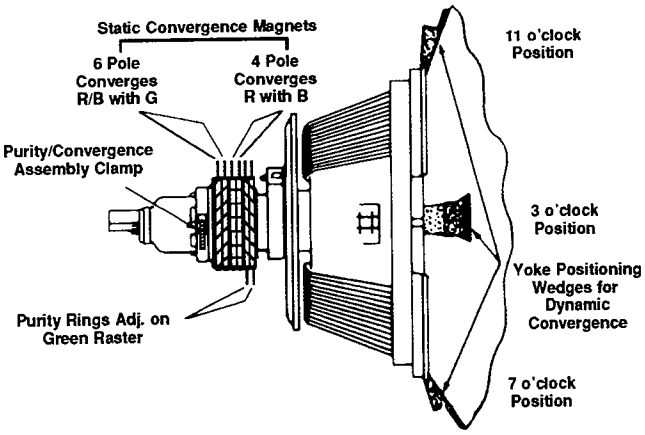
Apply adhesive between tab (thin portion) of wedge and CRT and place tape over tab to secure CRT.




**As the yoke is moved vertically, the rasters produced by the outside guns rotate in opposite directions.**


B G R
Raster produced from one of the outside electron beams
Raster from the other outside electron beam
Static convergence magnets are set for center convergence

**As the yoke is moved horizontally, one raster gets larger while the other gets smaller**


Static Convergence Magnets
6 Pole Converges R/B with G
4 Pole Converges R with B
11 o'clock Position
Purity/Convergence Assembly Clamp
3 o'clock Position
Yoke Positioning Wedges for Dynamic Convergence
Purity Rings Adj. on Green Raster
7 o'clock Position

## Permalloy Convergence Corrector Strip (Part No. OFMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.

First converge the set without the strip and observe the corners.

If correction is needed:

1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.

# New Circuits

## Horizontal Disable Circuit (X–Ray Protection)

This circuit protects against both excessive high voltage and CRT beam current. If for any reason high voltage and/or beam current exceeds a predetermined level, the circuit operates to shift horizontal frequency and limit high voltage.

Horizontal pulses from pin 6 of flyback transformer T551 are rectified by diode D531. The resultant positive DC voltage at the cathode of D531 is directly proportional to high voltage variations. This voltage is filtered and applied to the base of transistor Q531 via R532/R533 precision resistive divider.

The emitter voltage of Q531 is clamped by zener diode D533 to establish Q531's operating level. Under normal operation conditions, Q531 is cutoff, thus its collector is at the +12 volts (source), which also keeps transistors Q532 and Q533 non–conductive.

If high voltage should increase, the horizontal pulse amplitude at pin 6 of flyback T551 increases, so the positive voltage at the cathode of D531 also increases. At a specified high voltage level, Q531 conducts, and the voltage at its collector and at the base of PNP transistor Q532 decreases.

Transistor Q532 conducts and the voltage drop across its collector resistor causes transistor Q533 to conduct. Q533 acts as a resistance in parallel with the Horizontal AFC Filter circuit R503/C506/C507. As it conducts, its resistance lowers and thus dampens the Horizontal AFC Filter circuit. This produces an increase in the horizontal oscillator frequency and lowers the high voltage.

Increased CRT beam current produces more ABL negative voltage at pin 3 of T551, which is coupled to the emitter of Q531 via R534. This increased negative voltage opposes Q531's positive emitter voltage,which brings the transistor closer to conduction. Thus, excessive levels of high voltage and CRT beam current causes conduction of all three transistors to assure operation within safe limits.

As an added precaution against X–radiation, when Q532 conducts and its emitter voltage lowers, Q454 conducts to blank the CRT. The negative going voltage from the emitter of Q532 is coupled to the base of Q454 via R540. This causes Q454 to conduct, and the voltage drop across its collector resistor causes diode D454 to conduct and apply roughly +12 volts to the Y–Output (video line). The +12 volts drives the video information into the black area and causes the picture screen to go black.

## Servicing Procedure

If the horizontal is off frequency, the cause must be determined to be either the disable circuit or horizontal circuit. Also, if the disable circuit does not operate during the "Horizontal Disable Test" specified in this manual, the fault must be corrected in order to insure that high voltage and CRT beam current do not exceed safe operation parameters.

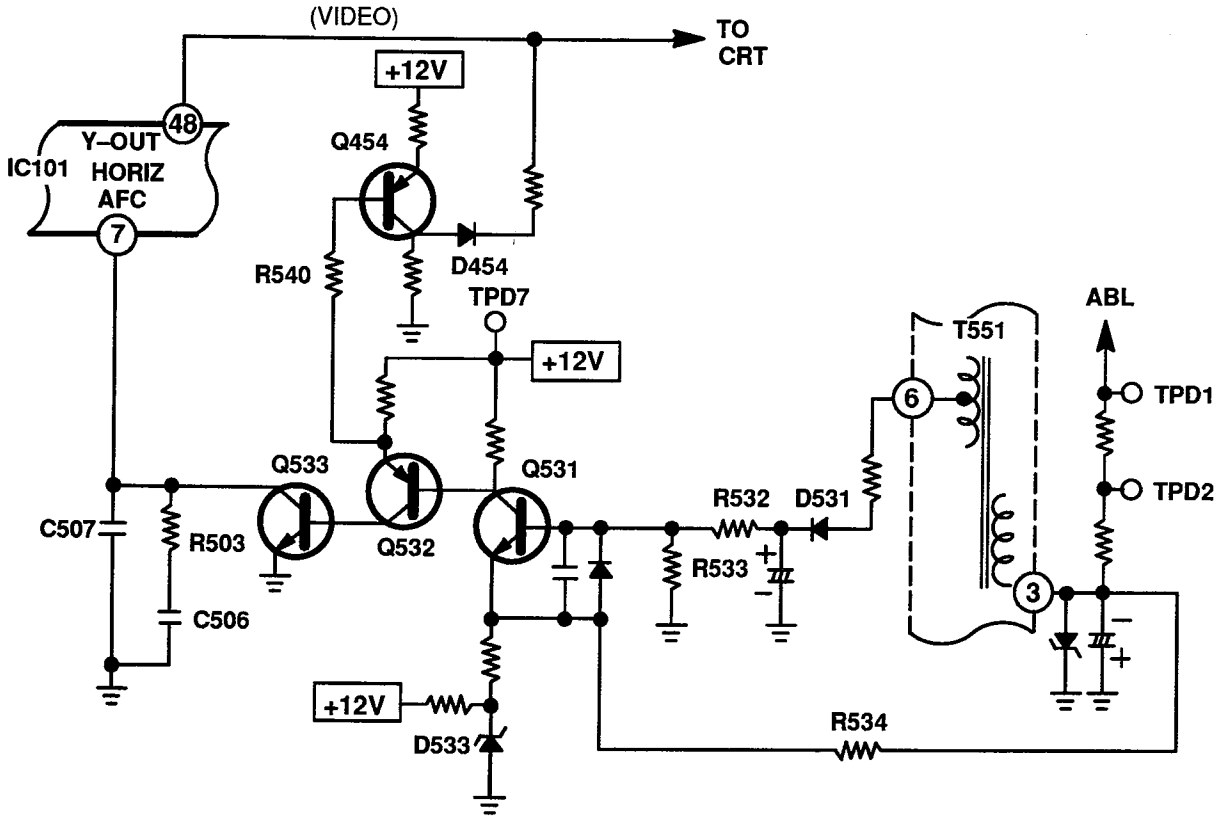
**SYMPTOM – No Change in Frequency When "Horizontal Disable Test" is Performed.**

**NOTE: B+ (TP91) should increase between 153 – 162 volts when disable test is performed.**

1. Turn ON Transistors Q533/Q532/Q531. Connect a 33k resistor jumper as follows:
   - Q533 – base to TPD7 (+12V)
   - Q532 – base to TPS9 (ground)
   - Q531 – base to TPD7(+12V)

Horizontal frequency should increase as each transistor is activated. Check out the stage where this does not occur.

2. If all transistors turn ON, check voltage at base of Q531. If low or zero, check R532, C531, D531, R531 and the amplitude of waveform at Pin 6 of flyback transformer T551.



# New Circuits

## CRT Protection Circuit

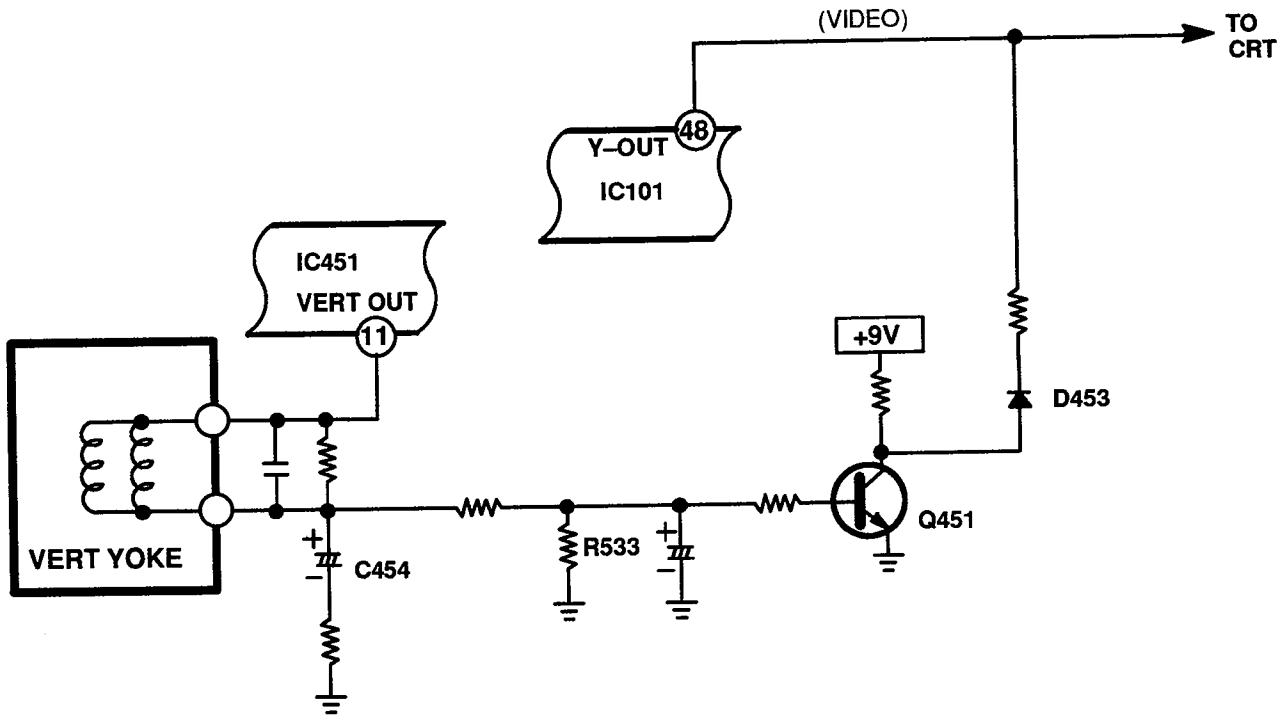
This circuit blanks the CRT in the event of vertical sweep loss and also functions as a CRT spot killer when the Receiver is turned OFF.

During normal operation the vertical sweep waveform from vertical output (IC451) supplies a positive voltage to the base of Q451. Its conduction grounds the anode of D453 and the diode does not conduct, to allow normal video.

Any failure mode causing loss of the vertical sweep waveform will allow the charge on C454 to discharge and results in the voltage at the base of Q451 to decrease and stop its conduction. This allows D453 to conduct and supply roughly +9 volts to the video path going to the CRT. The increased DC voltage drives the video information into the black area and blanks the CRT.

When the Receiver is turned OFF, the vertical sweep waveform disappears but the +9 volts decays slowly. Thus the circuit operates to blank the CRT to provide spot burn protection.

Note that any failure mode causing transistor Q451 to be non-conductive will result in the CRT to blank. The easiest way to confirm that the blanking circuit is active, causing a no raster symptom, is to measure the collector voltage of Q451. If it is approximately +9 volts, then D453 is conducting to cause CRT blanking.



# REPLACEMENT PARTS LIST

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| Ref. No. | Part No. | Description |
|---|---|---|
| **CAPRISTORS** | | |
| **CRA801** | **EXNG131P155** | **RES-CAP 130PF/1.5MEG** |
| **CAPACITORS** | | |
| C001 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C002 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C004 | ECKF1H101KB | CAP,C 100PF-K-50V |
| C005 | ECKF1H101KB | CAP,C 100PF-K-50V |
| C006 | ECKF1H101KB | CAP,C 100PF-K-50V |
| C007 | ECKF1H101KB | CAP,C 100PF-K-50V |
| C009 | ECEA1HU010 | CAP,E 1UF/50V |
| C010 | ECEA1HU4R7 | CAP,E 4.7UF/50V |
| C011 | ECEA1HU4R7 | CAP,E 4.7UF/50V |
| C012 | ECEA1HU4R7 | CAP,E 4.7UF/50V |
| C013 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C014 | ECEA0JU222 | CAP,E 2200UF/6.3V |
| C017 | ECEA0JU101 | CAP,E 100UF/6.3V |
| C018 | ECEA1CU100 | CAP,E 10UF/16V |
| C019 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C021 | ECKF1H821KB | CAP,C 820PF-K-50V |
| C022 | ECCF1H270JP | CAP,C 27PF-J-50V |
| C023 | ECCF1H120JP | CAP,C 12PF-J-50V |
| C024 | ECEA0JU101 | CAP,E 100UF/6.3V |
| C025 | ECKF1H561KB | CAP,C 560PF-K-50V |
| C026 | ECEA1CU102 | CAP,E 1000UF/16V |
| C027 | ECEA1CU100 | CAP,E 10UF/16V |
| C028 | ECSZ16EF10 | CAP,T 10UF/16V |
| C029 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C030 | ECEA1CU100 | CAP,E 10UF/16V |
| C031 | ECRHA030E41 | TRIMMER: 30PF |
| C034 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C035 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C037 | ECEA0JU101 | CAP,E 100UF/6.3V |
| C044 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C045 | ECEA1CU102 | CAP,E 1000UF/16V |
| C057 | ECEA1CU100 | CAP,E 10UF/16V |
| C071 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C103 | ECCF1H020CC | CAP,C 2PF-C-50V |
| C104 | ECCF1H020CC | CAP,C 2PF-C-50V |
| C105 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C106 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C109 | ECEA50ZR22 | CAP,E .22UF/50V |
| C110 | ECEA50ZR47 | CAP,E .47UF/50V |
| C112 | ECCF1H180JC | CAP,C 18PF-J-50V |
| C115 | ECEA1AU101 | CAP,E 100UF/10V |
| C119 | ECKF1H561KB | CAP,C 560PF-K-50V |
| C120 | ECEA0JU101 | CAP,E 100UF/6.3V |
| C121 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C122 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C126 | ECKF1H561KB | CAP,C 560PF-K-50V |
| C151 | ECCF1H680JC | CAP,C 68PF-J-50V |
| C152 | ECCF1H150JC | CAP,C 15PF-J-50V |
| C153 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C154 | ECEA1HUR22 | CAP,E .22UF/50V |
| C155 | ECCF1H020CC | CAP,C 2PF-C-50V |
| C201 | ECCF1H820K | CAP,C 82PF-K-50V |
| C202 | ECEA1HN010S | CAP,E 1UF/50V |
| C203 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C207 | ECCF1H680KP | CAP,C 68PF-K-50V |
| C212 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C214 | ECEA1CU100 | CAP,E 10UF/16V |
| C217 | ECCF1H820K | CAP,C 82PF-K-50V |
| C301 | ECEA1CN100S | CAP,E 10UF/16V |
| C302 | ECEA1CU220 | CAP,E 22UF/16V |
| C303 | ECEA1HU3R3 | CAP,E 3.3UF/50V |
| C305 | ECEA1CU100 | CAP,E 10UF/16V |
| C306 | ECEA1HU2R2 | CAP,E 2.2UF/50V |
| C307 | ECEA1HU0R1 | CAP,E .1UF/50V |
| C309 | ECEA1HU010 | CAP,E 1UF/50V |
| C310 | ECEA1HU010 | CAP,E 1UF/50V |
| C312 | ECEA1CU220 | CAP,E 22UF/16V |
| C314 | ECCF1H180JC | CAP,C 18PF-J-50V |
| C321 | ECEA1AN470S | CAP,E 47UF/10V |
| C322 | ECQM1H473KV | CAP,P .047UF-K-50V |
| C323 | ECQM1H103KV | CAP,P .01UF-K-50V |
| C324 | ECQM1H103KV | CAP,P .01UF-K-50V |
| C325 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C350 | ECKD3D102KB | CAP,C .001UF-K-2KV |
| C351 | ECKF1H471KB | CAP,C 470PF-K-50V |
| C352 | ECKF1H471KB | CAP,C 470PF-K-50V |
| C353 | ECKF1H681KB | CAP,C 680PF-K-50V |
| C355 | ECKD2H102KB | CAP,C .001UF-K-500V |
| C360 | ECKF1H331KB | CAP,C 330PF-K-50V |
| C401 | ECEA1HU010 | CAP,E 1UF/50V |
| C402 | ECQM1H223KV | CAP,P .022UF-K-50V |
| C403 | ECEA1HU2R2 | CAP,E 2.2UF/50V |
| C405 | ECKF1H122KB | CAP,C .0012UF-K-50V |
| C451 | ECEA1CU221 | CAP,E 220UF/16V |
| C452 | ECSZ25EF1V | CAP,T 1UF/25V |
| C453 | ECEA50Z1R5 | CAP,E 1.5UF/50V |
| C454 | ECEA1EU102 | CAP,E 1000UF/25V |
| C455 | ECEA1VU101 | CAP,E 100UF/35V |
| C457 | ECEA1HU0R1 | CAP,E .1UF/50V |
| C458 | ECEA1CU100 | CAP,E 10UF/16V |
| C459 | ECQM1103KZ | CAP,P .01UF-K-100V |
| C501 | ECQM1H822KV | CAP,P .0082UF-K-50V |
| C502 | ECQM1H183KV | CAP,P .018UF-K-50V |
| C503 | ECCF1H221JU | CAP,C 220PF-J-50V |
| C504 | ECEA1AU331 | CAP,E 330UF/10V |
| C505 | ECKF1H221KB | CAP,C 220PF-K-50V |
| C506 | ECEA1HU010 | CAP,E 1UF/50V |
| C507 | ECQM1H333KV | CAP,P .033UF-K-50V |
| C512 | ECKF1H681KB | CAP,C 680PF-K-50V |
| C513 | ECCD2H100F | CAP,C 10PF-F-500V |
| C514 | ECKD2H821KB | CAP,C 820PF-K-500V |
| C515 | ECKD2H821KB | CAP,C 820PF-K-500V |
| C518 | ECQM1H223KV | CAP,P .022UF-K-50V |
| **C531** | **ECEA1EU330** | **CAP,E 33UF/25V** |
| **C533** | **ECKF1H103ZF** | **CAP,C .01UF-Z-50V** |
| C541 | ECKF1H221KB | CAP,C 220PF-K-50V |
| C542 | ECKF1H101KB | CAP,C 100PF-K-50V |
| **C551** | **ECQF2H304JS** | **CAP,P .3UF-J-200V** |
| **C553** | **ECEA2EU100** | **CAP,E 10UF/250V** |
| C554 | ECKD2H561KB | CAP,C 560PF-K-500V |
| C555 | ECKD2H561KB | CAP,C 560PF-K-500V |
| C557 | ECEA1HU2R2 | CAP,E 2.2UF/50V |
| C558 | ECEA1AU331 | CAP,E 330UF/10V |
| **C559** | **ECEA1EU221** | **CAP,E 220UF/25V** |
| **C561** | **ECKD3D102JB** | **CAP,C .001UF-J-2KV** |
| —— | **ECKD3D471JB** | **CAP,C 470PF-J-2KV** |
| —— | **ECKD3D561JB** | **CAP,C 560PF-J-2KV** |
| —— | **ECKD3D681JB** | **CAP,C 680PF-J-2KV** |
| —— | **ECKD3D821JB** | **CAP,C 820PF-J-2KV** |
| **C563** | **ECWH12H822JS** | **CAP,P .0082UF-J-1.2KV** |
| **C566** | **ECEA1VU221** | **CAP,E 220UF/35V** |
| C567 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C570 | ECEA1CU221 | CAP,E 220UF/16V |
| C571 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C601 | ECKF1H103ZF | CAP,C .01UF-Z-50V |
| C605 | ECCF1H080DU | CAP,C 8PF-D-50V |
| C606 | ECEA50ZR47 | CAP,E .47UF/50V |
| C607 | ECKF1H101KB | CAP,C 100PF-K-50V |
| C608 | ECKF1H101KB | CAP,C 100PF-K-50V |
| C609 | ECKF1H101KB | CAP,C 100PF-K-50V |
| C610 | ECEA1HU3R3 | CAP,E 3.3UF/50V |
| C625 | ECEA1CU100 | CAP,E 10UF/16V |
| C626 | ECKF1H121KB | CAP,C 120PF-K-50V |
| **C802** | **ECKD2H472PU** | **CAP,C .0047UF-P-500V** |
| **C803** | **ECKD2H472PU** | **CAP,C .0047UF-P-500V** |
| **C804** | **ECKD2H472PU** | **CAP,C .0047UF-P-500V** |
| **C805** | **ECES2DU331G** | **CAP,E 330UF/200V** |
| **C806** | **ECEA2CU220** | **CAP,E 22UF/160V** |
| **C812** | **ECEA160V33Z** | **CAP,E 33UF/160V** |
| **C817** | **ECQU1A153KH** | **CAP,P .015UF-K-125VAC** |
| **C818** | **ECQU1A153KH** | **CAP,P .015UF-K-125VAC** |

# REPLACEMENT PARTS LIST

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| Ref. No. | Part No. | Description |
|---|---|---|
| **C819** | **ECKCFL222ZE** | **CAP,C .0022UF–Z–125VAC** |
| C2109 | ECEA1CU102 | CAP,E 1000UF/16V |
| C2110 | ECEA50ZR22 | CAP,E .22UF/50V |
| C2111 | ECEA50ZR22 | CAP,E .22UF/50V |
| C2112 | ECEA1CU100 | CAP,E 10UF/16V |
| C2113 | ECEA1CU100 | CAP,E 10UF/16V |
| C2147 | ECEA1HU010 | CAP,E 1UF/50V |
| C2152 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C2153 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C2154 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C2200 | ECEA1CN100S | CAP,E 10UF/16V |
| C2201 | ECEA1CU100 | CAP,E 10UF/16V |
| C2202 | ECQM1H123JV | CAP,P .012UF–J–50V |
| C2203 | ECQM1H562JV | CAP,P .0056UF–J–50V |
| C2204 | ECEA1HNR22S | CAP,E .22UF/50V |
| C2205 | ECEA1CU470 | CAP,E 47UF/16V |
| C2206 | ECEA1CU101 | CAP,E 100UF/16V |
| C2207 | ECQM1H272JV | CAP,P .0027UF–J–50V |
| C2208 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2209 | ECSZ16EF10 | CAP,T 10UF/16V |
| C2210 | ECEA1HU010 | CAP,E 1UF/50V |
| C2211 | ECSZ16EF3R3 | CAP,T 3.3UF/16V |
| C2212 | ECEA1EN4R7S | CAP,E 4.7UF/25V |
| C2213 | ECEA1EN4R7S | CAP,E 4.7UF/25V |
| C2214 | ECQM1H473JV | CAP,P .047UF–J–50V |
| C2215 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2219 | ECEA1HUR47 | CAP,E .47UF/50V |
| C2223 | ECEA1EU4R7 | CAP,E 4.7UF/25V |
| C2224 | ECQM1H332JV | CAP,P .0033UF–J–50V |
| C2301 | ECQM1H103KV | CAP,P .01UF–K–50V |
| C2302 | ECQM1H103KV | CAP,P .01UF–K–50V |
| C2303 | ECQM1H104JV | CAP,P .1UF–J–50V |
| C2304 | ECEA1EU471 | CAP,E 470UF/25V |
| C2305 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C2306 | ECKF1H101KB | CAP,C 100PF–K–50V |
| C2307 | ECEA1AU101 | CAP,E 100UF/10V |
| C2308 | ECEA1AU101 | CAP,E 100UF/10V |
| C2309 | ECEA1CU470 | CAP,E 47UF/16V |
| C2310 | ECEA1CU470 | CAP,E 47UF/16V |
| C2311 | ECEA1EU101 | CAP,E 100UF/25V |
| C2312 | ECQM1H104JV | CAP,P .1UF–J–50V |
| C2313 | ECEA1EU330 | CAP,E 33UF/25V |
| C2314 | ECEA1EU471 | CAP,E 470UF/25V |
| C2402 | ECKF1H472KB | CAP,C .0047UF–K–50V |
| C2403 | ECKF1H472KB | CAP,C .0047UF–K–50V |
| C2405 | ECEA1EU222 | CAP,E 2200UF/25V |
| C2406 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C2410 | ECKF1H472KB | CAP,C .0047UF–K–50V |
| C3004 | ECEA1AU220 | CAP,E 22UF/10V |
| C3007 | ECEA1HN3R3S | CAP,E 3.3UF/50V |
| C3008 | ECEA1HN3R3S | CAP,E 3.3UF/50V |
| C3009 | ECEA1HN3R3S | CAP,E 3.3UF/50V |
| C3010 | ECEA1HN3R3S | CAP,E 3.3UF/50V |
| C3013 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C3014 | ECEA1HU010 | CAP,E 1UF/50V |
| C3015 | ECEA1HU010 | CAP,E 1UF/50V |
| C3016 | ECEA1CU101 | CAP,E 100UF/16V |
| C3017 | ECEA1CU100 | CAP,E 10UF/16V |
| C3102 | ECKF1H561KB | CAP,C 560PF–K–50V |
| C3103 | ECEA1HU010 | CAP,E 1UF/50V |
| C3104 | ECEA1HU010 | CAP,E 1UF/50V |
| C3105 | ECEA1CU100 | CAP,E 10UF/16V |
| C3117 | ECEA1CU100 | CAP,E 10UF/16V |
| C3118 | ECEA1CU100 | CAP,E 10UF/16V |
| C3201 | ECEA1AU220 | CAP,E 22UF/10V |
| C3202 | ECCF1H560JC | CAP,C 56PF–J–50V |
| C3204 | ECCF1H100F | CAP,C 10PF–F–50V |
| C3205 | ECCF1H120JC | CAP,C 12PF–J–50V |
| C3206 | ECEA1CU470 | CAP,E 47UF/16V |
| C3207 | ECEA1AU220 | CAP,E 22UF/10V |
| C3208 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C3209 | ECEA1CU100 | CAP,E 10UF/16V |
| C3214 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C3215 | ECKF1H103ZF | CAP,C .01UF–Z–50V |
| C3216 | ECCF1H101J | CAP,C 100PF–J–50V |
| C3217 | ECEA1CU220 | CAP,E 22UF/16V |
| **DIODES** | | |
| D001 | MA165 | DIODE |
| D004 | MA165 | DIODE |
| D005 | TVSQA205D | DIODE |
| D020 | MA165 | DIODE |
| D021 | MA27TA | DIODE |
| D022 | MA161 | DIODE |
| D027 | MA150 | DIODE |
| D031 | ERA15–01 | DIODE |
| D032 | MA162 | DIODE |
| D034 | SEL1320G | DIODE, LED |
| D035 | SEL1120R | DIODE, LED |
| D302 | MA150 | DIODE |
| D304 | MA856 | DIODE |
| D352 | MA165 | DIODE |
| D353 | MA4047L | DIODE, ZENER |
| D383 | MA27WA | DIODE |
| D451 | ERA15–01 | DIODE |
| D452 | MA165 | DIODE |
| D453 | MA165 | DIODE |
| D454 | MA150 | DIODE |
| D470 | MA4047L | DIODE, ZENER |
| D502 | TVSQA208C | DIODE, ZENER |
| D506 | TVSQA206B | DIODE, ZENER |
| **D531** | **AS01** | **DIODE** |
| **D532** | **MA165** | **DIODE** |
| **D533** | **TVSQA208G** | **DIODE, ZENER** |
| D542 | MA165 | DIODE |
| **D551** | **RU2N** | **DIODE** |
| **D552** | **AS01** | **DIODE** |
| **D554** | **AS01** | **DIODE** |
| D555 | MA165 | DIODE |
| D556 | MA1360H | DIODE, ZENER |
| D557 | TVSQB105N | DIODE, ZENER |
| D560 | TVSQB109SA | DIODE, ZENER |
| D603 | MA150 | DIODE |
| **D801** | **ERC13–08** | **DIODE** |
| **D802** | **ERC13–08** | **DIODE** |
| **D803** | **ERC13–08** | **DIODE** |
| **D804** | **ERC13–08** | **DIODE** |
| **D806** | **ERPF5B0M050K** | **THERMISTOR** |
| D2201 | TVSQB109SA | DIODE, ZENER |
| D2401 | ERA15–02 | DIODE |
| D2402 | ERA15–02 | DIODE |
| D2403 | ERA15–02 | DIODE |
| D2404 | ERA15–02 | DIODE |
| D3101 | MA165 | DIODE |
| D3102 | MA165 | DIODE |
| D3253 | MA4110 | DIODE, ZENER |
| D3254 | MA4110 | DIODE, ZENER |
| D3255 | MA4110 | DIODE, ZENER |
| D3256 | MA4110 | DIODE, ZENER |
| D3257 | MA4110 | DIODE, ZENER |
| D3258 | MA4110 | DIODE, ZENER |
| D3259 | MA4110 | DIODE, ZENER |
| **FUSES** | | |
| **F001** | **XBA1F40NU100** | **FUSE 4.0A/125V** |
| **INTEGRATED CIRCUITS** | | |
| IC001 | MN15151Q14 | INT CKT |
| IC002 | MN1280R | INT CKT |
| **IC101** | **AN5160NK–N** | **INT CKT** |
| IC451 | LA7835–TV | INT CKT |
| **IC551** | **AN78M12** | **PLUS 12V AVR** |
| **IC801** | **TVSSTR30130** | **INT CKT** |
| IC2101 | AN5836 | BAL, TONE, VOLUME CONTROL |
| IC2102 | TVSM5218L | INT CKT |

# REPLACEMENT PARTS LIST

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| Ref. No. | Part No. | Description |
|---|---|---|
| IC2200 | CXA1124AS | INT CKT |
| IC2301 | AN7158N | DUAL AUDIO POWER AMP |
| IC3002 | M52055P | INT CKT |
| IC3201 | M52055P | INT CKT |
| **COILS** | | |
| L006 | TLUABTA5R6K | COIL, PEAKING 5.6UH |
| L007 | TLUABTA5R6K | COIL, PEAKING 5.6UH |
| L008 | TLUABTA5R6K | COIL, PEAKING 5.6UH |
| L010 | EXCELSA24T | FERRITE BEAD |
| L011 | TLUABTA1R0K | COIL, PEAKING 1.0UH |
| L103 | TLI67394-1 | COIL, AFT |
| L104 | TLQ012K205C | COIL, PEAKING 1.2UH |
| L105 | TLI158755 | COIL, VCO |
| L106 | TLUABTA150K | COIL, PEAKING 15UH |
| L108 | TLQ012K205C | COIL, PEAKING 1.2UH |
| L109 | EXCELSA35B | FERRITE BEAD |
| L201 | EIS1EG011B | COIL, QUADRATURE |
| L202 | TLUABTA4R7K | COIL, PEAKING 4.7UH |
| L304 | TLK153152 | COMB FILTER |
| L306 | EFDEN645B35B | DELAY LINE |
| L354 | TLUABTA151K | COIL, PEAKING 150UH |
| **L551** | **TLH15654P** | **COIL, LINEARITY** |
| **L555** | **EXCELSA24B** | **FERRITE BEAD** |
| **L556** | **EXCELSA24B** | **FERRITE BEAD** |
| L561 | EXCELSA24T | FERRITE BEAD |
| **L570** | **TLY25397F** | **YOKE, DEFLECTION** |
| **L801** | **ELF18D650A** | **CHOKE, AC LINE** |
| **L804** | **0LK19017-1F** | **COIL, DEGAUSSING** |
| L3201 | ELEPH820JA | COIL, PEAKING 82UH |
| L3205 | TLUABTA120K | COIL, PEAKING 12UH |
| L3207 | ELEPH390JA | COIL, PEAKING 39UH |
| **TRANSISTORS** | | |
| Q001 | 2SC1685QR | TRANSISTOR |
| Q002 | 2SA564AQR | TRANSISTOR |
| Q004 | 2SC1685QR | TRANSISTOR |
| Q005 | 2SA564AQR | TRANSISTOR |
| Q006 | 2SC1685QR | TRANSISTOR |
| Q007 | 2SC1685QR | TRANSISTOR |
| Q019 | 2SC1685QR | TRANSISTOR |
| Q102 | 2SA564AQR | TRANSISTOR |
| Q301 | 2SC1685QR | TRANSISTOR |
| Q303 | 2SA719QR | TRANSISTOR |
| Q304 | 2SC1685QR | TRANSISTOR |
| Q316 | 2SC1685QR | TRANSISTOR |
| Q321 | 2SD637Q | TRANSISTOR |
| Q322 | 2SD637Q | TRANSISTOR |
| Q323 | 2SD637Q | TRANSISTOR |
| Q324 | 2SD637Q | TRANSISTOR |
| Q325 | 2SD637Q | TRANSISTOR |
| Q351 | 2SC1573NC | TRANSISTOR |
| Q352 | 2SC1573NC | TRANSISTOR |
| Q353 | 2SC1573NC | TRANSISTOR |
| Q451 | 2SC1685QR | TRANSISTOR |
| Q454 | 2SA564AQR | TRANSISTOR |
| Q501 | 2SC1573AH | TRANSISTOR |
| **Q531** | **2SC1685QR** | **TRANSISTOR** |
| **Q532** | **2SA564AQR** | **TRANSISTOR** |
| **Q533** | **2SC1685QR** | **TRANSISTOR** |
| Q541 | 2SC1685QR | TRANSISTOR |
| **Q551** | **2SD1439P** | **TRANSISTOR** |
| Q601 | 2SC1685QR | TRANSISTOR |
| Q602 | 2SC1685QR | TRANSISTOR |
| Q603 | 2SC1685QR | TRANSISTOR |
| Q604 | 2SC1685QR | TRANSISTOR |
| Q2201 | 2SD637Q | TRANSISTOR |
| Q2203 | 2SD637Q | TRANSISTOR |
| Q3102 | 2SC1685QR | TRANSISTOR |
| Q3103 | 2SC1685QR | TRANSISTOR |
| Q3104 | 2SA564AQR | TRANSISTOR |
| Q3105 | 2SC1685QR | TRANSISTOR |
| Q3216 | 2SD637R | TRANSISTOR |
| Q3255 | 2SD637Q | TRANSISTOR |
| **RELAYS** | | |
| **RL001** | **TSE1864** | **RELAY** |
| **RESISTORS** | | |
| R001 | ERD25TJ122 | RES,C 1.2K-J-1/4 |
| R002 | ERD25TJ103 | RES,C 10K-J-1/4 |
| R004 | ERDS2TJ102 | RES,C 1K-J-1/4 |
| R005 | ERDS2TJ102 | RES,C 1K-J-1/4 |
| R008 | ERD25TJ182 | RES,C 1.8K-J-1/4 |
| R009 | ERD25TJ182 | RES,C 1.8K-J-1/4 |
| R012 | ERDS2TJ103 | RES,C 10K-J-1/4 |
| R013 | ERDS2TJ473 | RES,C 47K-J-1/4 |
| R015 | ERDS2TJ103 | RES,C 10K-J-1/4 |
| R016 | ERDS2TJ222 | RES,C 2.2K-J-1/4 |
| R020 | ERDS2TJ392 | RES,C 3.9K-J-1/4 |
| R021 | ERDS2TJ682 | RES,C 6.8K-J-1/4 |
| R022 | ERDS2TJ273 | RES,C 27K-J-1/4 |
| R023 | ERDS2TJ392 | RES,C 3.9K-J-1/4 |
| R024 | ERDS2TJ683 | RES,C 68K-J-1/4 |
| R025 | ERDS2TJ331 | RES,C 330-J-1/4 |
| R028 | ERDS2TJ331 | RES,C 330-J-1/4 |
| R030 | ERDS2TJ823 | RES,C 82K-J-1/4 |
| R031 | ERDS2TJ823 | RES,C 82K-J-1/4 |
| R032 | ERD25TJ562 | RES,C 5.6K-J-1/4 |
| R035 | ERD25TJ331 | RES,C 330-J-1/4 |
| R037 | ERDS2TJ822 | RES,C 8.2K-J-1/4 |
| R038 | ERDS2TJ562 | RES,C 5.6K-J-1/4 |
| R039 | ERDS2TJ562 | RES,C 5.6K-J-1/4 |
| R040 | ERDS2TJ562 | RES,C 5.6K-J-1/4 |
| R042 | ERDS2TJ203 | RES,C 20K-J-1/4 |
| R043 | ERDS2TJ203 | RES,C 20K-J-1/4 |
| R044 | ERDS2TJ203 | RES,C 20K-J-1/4 |
| R045 | ERDS2TJ822 | RES,C 8.2K-J-1/4 |
| R047 | ERDS2TJ102 | RES,C 1K-J-1/4 |
| R049 | ERDS2TJ223 | RES,C 22K-J-1/4 |
| R050 | ER0S2CKF1002 | RES,M 10K-F-1/4 |
| R051 | ER025CKF1002 | RES,M 10K-F-1/4 |
| R052 | ERDS2TJ333 | RES,C 33K-J-1/4 |
| R053 | ERD25TJ224 | RES,C 220K-J-1/4 |
| R055 | ERDS1FJ330 | RES,C 33-J-1/2 |
| R056 | ERDS2TJ562 | RES,C 5.6K-J-1/4 |
| R057 | ERD25TJ182 | RES,C 1.8K-J-1/4 |
| R058 | ERDS2TJ222 | RES,C 2.2K-J-1/4 |
| R059 | ERDS2TJ222 | RES,C 2.2K-J-1/4 |
| R060 | ERDS2TJ332 | RES,C 3.3K-J-1/4 |
| R061 | ERDS2TJ512 | RES,C 5.1K-J-1/4 |
| R062 | ERDS2TJ912 | RES,C 9.1K-J-1/4 |
| R064 | ERDS2TJ222 | RES,C 2.2K-J-1/4 |
| R065 | ERDS2TJ222 | RES,C 2.2K-J-1/4 |
| R066 | ERDS2TJ332 | RES,C 3.3K-J-1/4 |
| R067 | ERD25TJ512 | RES,C 5.1K-J-1/4 |
| R068 | ERDS2TJ912 | RES,C 9.1K-J-1/4 |
| R069 | ER025CKF2102 | RES,M 21K-F-1/4 |
| R071 | ERD25TJ392 | RES,C 3.9K-J-1/4 |
| R072 | ERDS2TJ473 | RES,C 47K-J-1/4 |
| R073 | ERDS2TJ823 | RES,C 82K-J-1/4 |
| R074 | ERG1SJ683 | RES,M 68K-J-1W |
| R078 | ERD25TJ101 | RES,C 100-J-1/4 |
| R079 | ERD25TJ561 | RES,C 560-J-1/4 |
| R080 | ERDS2TJ391 | RES,C 390-J-1/4 |
| R081 | ERDS2TJ122 | RES,C 1.2K-J-1/4 |
| R083 | ERDS2TJ103 | RES,C 10K-J-1/4 |
| R085 | ERDS2TJ393 | RES,C 39K-J-1/4 |
| R086 | ERDS2TJ473 | RES,C 47K-J-1/4 |
| R087 | ERDS2TJ472 | RES,C 4.7K-J-1/4 |
| R088 | ERDS2TJ183 | RES,C 18K-J-1/4 |
| R090 | ERDS2TJ622 | RES,C 6.2K-J-1/4 |
| R092 | ERD25TJ272 | RES,C 2.7K-J-1/4 |

# REPLACEMENT PARTS LIST

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| Ref. No. | Part No. | Description |
|---|---|---|
| R093 | ERDS2TJ682 | RES,C 6.8K–J–1/4 |
| R094 | ERD25TJ562 | RES,C 5.6K–J–1/4 |
| R095 | ERD25TJ101 | RES,C 100–J–1/4 |
| R096 | ERD25TJ101 | RES,C 100–J–1/4 |
| R097 | ERD25TJ101 | RES,C 100–J–1/4 |
| R106 | EVN60AA00B53 | CONTROL 5K |
| R107 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R108 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R109 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R110 | ERDS2TJ822 | RES,C 8.2K–J–1/4 |
| R111 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R112 | ERDS2TJ121 | RES,C 120–J–1/4 |
| R113 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R114 | EVND4AA00B52 | CONTROL 500 OHM |
| R120 | ERDS2TJ563 | RES,C 56K–J–1/4 |
| R151 | ERDS2TJ274 | RES,C 270K–J–1/4 |
| R152 | ERD25TJ104 | RES,C 100K–J–1/4 |
| R153 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R201 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R203 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R209 | ERDS2TJ122 | RES,C 1.2K–J–1/4 |
| R212 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R213 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R214 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R303 | ERDS2TJ182 | RES,C 1.8K–J–1/4 |
| R304 | EVND4AA00B23 | CONTROL 2K |
| R305 | ERDS2TJ153 | RES,C 15K–J–1/4 |
| R306 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R307 | ERDS2TJ470 | RES,C 47–J–1/4 |
| R308 | ERDS2TJ683 | RES,C 68K–J–1/4 |
| R309 | ERDS2TJ333 | RES,C 33K–J–1/4 |
| R310 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R311 | ERD25TJ151 | RES,C 150–J–1/4 |
| R313 | ERDS2TJ123 | RES,C 12K–J–1/4 |
| R314 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R315 | ERDS2TJ393 | RES,C 39K–J–1/4 |
| R316 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R317 | ERDS2TJ203 | RES,C 20K–J–1/4 |
| R318 | EVN60AA00B14 | CONTROL 10K |
| R319 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R320 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R321 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R322 | ERDS2TJ682 | RES,C 6.8K–J–1/4 |
| R323 | ERDS2TJ393 | RES,C 39K–J–1/4 |
| R324 | ERDS2TJ185 | RES,C 1.8MEG–J–1/4 |
| R326 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R327 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R328 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R329 | ERDS2TJ151 | RES,C 150–J–1/4 |
| R330 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R331 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R332 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R333 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R334 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R335 | EVN60AA00B22 | CONTROL 200 OHM |
| R336 | ERD25TJ222 | RES,C 2.2K–J–1/4 |
| R337 | ERDS2TJ224 | RES,C 220K–J–1/4 |
| R338 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R339 | ERDS2TJ393 | RES,C 39K–J–1/4 |
| R340 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R341 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R342 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R343 | ERDS2TJ822 | RES,C 8.2K–J–1/4 |
| R344 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R345 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R346 | ERDS2TJ821 | RES,C 820–J–1/4 |
| R351 | ERG2ANJ123 | RES,M 12K–J–2W |
| R352 | ERG2ANJ123 | RES,M 12K–J–2W |
| R354 | EVN49AA00B23 | CONTROL 2K |
| R355 | EVN49AA00B23 | CONTROL 2K |
| R356 | EVN49AA00B23 | CONTROL 2K |
| R357 | EVN49AA00B32 | CONTROL 300 OHM |
| R358 | EVN49AA00B32 | CONTROL 300 OHM |
| R360 | ERDS2TJ181 | RES,C 180–J–1/4 |
| R361 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R363 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R367 | ERDS2TJ221 | RES,C 220–J–1/4 |
| R368 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R374 | ERDS1TJ272 | RES,C 2.7K–J–1/2 |
| R375 | ERDS1TJ272 | RES,C 2.7K–J–1/2 |
| R379 | ERDS1TJ272 | RES,C 2.7K–J–1/2 |
| R380 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R381 | ERG2ANJ123 | RES,M 12K–J–2W |
| R382 | ERDS2TJ821 | RES,C 820–J–1/4 |
| R383 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R384 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R401 | ERDS2TJ684 | RES,C 680K–J–1/4 |
| R402 | ERDS2TJ681 | RES,C 680–J–1/4 |
| R403 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R451 | ERD25TJ122 | RES,C 1.2K–J–1/4 |
| R452 | ERDS2TJ273 | RES,C 27K–J–1/4 |
| R453 | EVN60AA00B54 | CONTROL 50K |
| R454 | ERDS1FJ2R2 | RES,C 2.2–J–1/2 |
| R455 | ERDS2TJ183 | RES,C 18K–J–1/4 |
| R456 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R457 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R458 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R460 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R461 | ERDS2TJ113 | RES,C 11K–J–1/4 |
| R462 | ERD25TJ103 | RES,C 10K–J–1/4 |
| R463 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R464 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R465 | ERD25TJ222 | RES,C 2.2K–J–1/4 |
| R466 | ERDS2TJ153 | RES,C 15K–J–1/4 |
| R469 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R471 | ERDS2TJ163 | RES,C 16K–J–1/4 |
| R501 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R502 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R503 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R505 | ERDS2TJ821 | RES,C 820–J–1/4 |
| R506 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R508 | ERDS2TJ821 | RES,C 820–J–1/4 |
| **R509** | **ERG2ANJ562** | **RES,M 5.6K–J–2W** |
| **R510** | **ERG2ANJ272** | **RES,M 2.7K–J–2W** |
| R513 | ERDS2TJ105 | RES,C 1MEG–J–1/4 |
| R516 | ERD25TJ391 | RES,C 390–J–1/4 |
| R524 | EVND4AA00B22 | CONTROL 200 OHM |
| **R531** | **ERD25FJ470** | **RES,C 47–J–1/4** |
| **R532** | **ER0S2CKF2432** | **RES,M 24.3K–F–1/4** |
| **R533** | **ER0S2CKF1652** | **RES,M 16.5K–F–1/4** |
| **R534** | **ERDS2TJ154** | **RES,C 150K–J–1/4** |
| **R535** | **ERDS2TJ272** | **RES,C 2.7K–J–1/4** |
| **R536** | **ERDS2TJ821** | **RES,C 820–J–1/4** |
| **R537** | **ERDS2TJ183** | **RES,C 18K–J–1/4** |
| **R538** | **ERDS2TJ822** | **RES,C 8.2K–J–1/4** |
| **R539** | **ERDS2TJ153** | **RES,C 15K–J–1/4** |
| R540 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R541 | ERD25TJ101 | RES,C 100–J–1/4 |
| R542 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R544 | ERD25TJ223 | RES,C 22K–J–1/4 |
| R547 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| **R551** | **ERQ1CJP1R0** | **RES,F 1.0–J–1W** |
| **R552** | **ERDS1FJ1R0** | **RES,C 1.0–J–1/2** |
| R554 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R555 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R556 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R557 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| **R558** | **ERQ1CJP1R2** | **RES,F 1.2–J–1W** |
| R559 | ERG3ANJ680 | RES,M 68–J–3W |
| R560 | ERG2SJS680 | RES,M 68–J–2W |
| **R562** | **ERG1ANJ122** | **RES,M 1.2K–J–1W** |
| **R569** | **ERG2ANJ270** | **RES,M 27–J–2W** |
| R570 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R604 | ERDS2TJ224 | RES,C 220K–J–1/4 |
| R609 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R610 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R611 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R615 | ERD25TJ102 | RES,C 1K–J–1/4 |

# REPLACEMENT PARTS LIST

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| Ref. No. | Part No. | Description |
|---|---|---|
| R616 | ERD25TJ102 | RES,C 1K–J–1/4 |
| R617 | ERDS2TJ823 | RES,C 82K–J–1/4 |
| R618 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R619 | EVND4AA00B53 | CONTROL 5K |
| R620 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R621 | ERDS2TJ273 | RES,C 27K–J–1/4 |
| R622 | ERD25TJ822 | RES,C 8.2K–J–1/4 |
| R623 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R624 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R626 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R628 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R629 | ERDS2TJ822 | RES,C 8.2K–J–1/4 |
| R630 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R631 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R632 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| **R801** | **ERF5ZKR82** | **RES,W .82–K–5W** |
| **R802** | **ERF15ZJ181** | **RES,W 180–J–15W** |
| **R804** | **ERDS2TJ224** | **RES,C 220K–J–1/4** |
| **R805** | **ERDS1TJ103** | **RES,C 10K–J–1/2** |
| **R807** | **ERD25FJ470** | **RES,C 47–J–1/4** |
| **R808** | **ERD25FJ330** | **RES,C 33–J–1/4** |
| **R810** | **ERQ3CJ5R6** | **RES,F 5.6–J–3W** |
| **R811** | **ERX3ANJ4R7** | **RES,M 4.7–J–3W** |
| **R815** | **ERC12ZGK275** | **RES,S 2.7MEG–K–1/2** |
| **R816** | **ERW12PK1R0** | **RES,W 1.0–K–1/2** |
| R1103 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R2119 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R2120 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R2121 | ERD25FJ330 | RES,C 33–J–1/4 |
| R2124 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2149 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2152 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2156 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R2200 | EVN60AA00B14 | CONTROL 10K |
| R2202 | ERDS2TJ683 | RES,C 68K–J–1/4 |
| R2203 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R2204 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2205 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R2207 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R2208 | ERDS2TJ105 | RES,C 1MEG–J–1/4 |
| R2209 | EVND4AA00B14 | CONTROL 10K |
| R2210 | ER0S2CKF4302 | RES,M 43K–F–1/4 |
| R2211 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R2212 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R2213 | EVND4AA00B53 | CONTROL 5K |
| R2215 | ERDS2TJ392 | RES,C 3.9K–J–1/4 |
| R2216 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R2217 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2218 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2219 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R2220 | EVND4AA00B54 | CONTROL 50K |
| R2221 | EVND4AA00B24 | CONTROL 20K |
| R2222 | ER0S2CKF4422 | RES,M 44.2K–F–1/4 |
| R2228 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R2229 | ERDS2TJ223 | RES,C 22K–J–1/4 |
| R2231 | ERDS2TJ153 | RES,C 15K–J–1/4 |
| R2232 | ERDS2TJ153 | RES,C 15K–J–1/4 |
| R2234 | ERDS2TJ823 | RES,C 82K–J–1/4 |
| R2235 | ERDS2TJ562 | RES,C 5.6K–J–1/4 |
| R2236 | ERDS2TJ154 | RES,C 150K–J–1/4 |
| R2237 | ERDS1FJ560 | RES,C 56–J–1/2 |
| R2238 | ER0S2CKF4702 | RES,M 47K–F–1/4 |
| R2245 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R2246 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R2248 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R2253 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R2254 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2301 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R2302 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R2303 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R2304 | ERDS2TJ152 | RES,C 1.5K–J–1/4 |
| R2305 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2306 | ERD25FJ4R7 | RES,C 4.7–J–1/4 |
| R2307 | ERDS2TJ123 | RES,C 12K–J–1/4 |
| R2308 | ERDS2TJ123 | RES,C 12K–J–1/4 |
| R2309 | ERD25FJ4R7 | RES,C 4.7–J–1/4 |
| R2310 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R2311 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R2312 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R2403 | ERQ12HKR68 | RES,F .68–K–1/2 |
| R3018 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3019 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3032 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R3033 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R3034 | ERDS2TJ272 | RES,C 2.7K–J–1/4 |
| R3035 | ERDS2TJ104 | RES,C 100K–J–1/4 |
| R3040 | ERDS2TJ390 | RES,C 39–J–1/4 |
| R3046 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R3051 | ERDS2TJ750 | RES,C 75–J–1/4 |
| R3101 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R3104 | ERDS2TJ154 | RES,C 150K–J–1/4 |
| R3105 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R3106 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R3107 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R3108 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R3109 | ERDS2TJ154 | RES,C 150K–J–1/4 |
| R3110 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R3111 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R3112 | ERDS2TJ332 | RES,C 3.3K–J–1/4 |
| R3113 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3114 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3116 | ERDS2TJ561 | RES,C 560–J–1/4 |
| R3119 | ERDS2TJ822 | RES,C 8.2K–J–1/4 |
| R3120 | ERDS2TJ333 | RES,C 33K–J–1/4 |
| R3121 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R3123 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R3124 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R3130 | ERDS2TJ271 | RES,C 270–J–1/4 |
| R3131 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R3139 | ERDS2TJ563 | RES,C 56K–J–1/4 |
| R3201 | ERDS2TJ750 | RES,C 75–J–1/4 |
| R3202 | ERDS2TJ750 | RES,C 75–J–1/4 |
| R3203 | ERDS2TJ122 | RES,C 1.2K–J–1/4 |
| R3211 | ERDS2TJ101 | RES,C 100–J–1/4 |
| R3212 | ERDS2TJ471 | RES,C 470–J–1/4 |
| R3215 | ERDS2TJ473 | RES,C 47K–J–1/4 |
| R3216 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R3217 | ERDS2TJ472 | RES,C 4.7K–J–1/4 |
| R3220 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3233 | ERDS2TJ102 | RES,C 1K–J–1/4 |
| R3234 | ERDS2TJ331 | RES,C 330–J–1/4 |
| R3235 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R3236 | ERDS2TJ103 | RES,C 10K–J–1/4 |
| R3270 | ERDS2TJ222 | RES,C 2.2K–J–1/4 |
| R3271 | ERDS2TJ221 | RES,C 220–J–1/4 |
| **SWITCHES** | | |
| S001 | EVQQBH12T | SWITCH, PUSH |
| S002 | EVQQBH12T | SWITCH, PUSH |
| S003 | EVQQBH12T | SWITCH, PUSH |
| S004 | EVQQBH12T | SWITCH, PUSH |
| S005 | EVQQBH12T | SWITCH, PUSH |
| S006 | EVQQBH12T | SWITCH, PUSH |
| S008 | EVQQBH12T | SWITCH, PUSH |
| S009 | EVQQBH12T | SWITCH, PUSH |
| S010 | EVQQBH12T | SWITCH, PUSH |
| S011 | EVQQBH12T | SWITCH, PUSH |
| S013 | EVQQBH12T | SWITCH, PUSH |
| S014 | ESB621309 | CATV SW (INCLUDE S015) |
| **TRANSFORMERS** | | |
| **T001** | **TLP16297** | **TRANSFORMER, POWER SUPPLY** |
| **T501** | **ETH19Y70AY** | **TRANSFORMER, HORIZONTAL DRIVER** |
| **T502** | **ETE19Z30AY** | **TRANSFORMER, HORIZONTAL COUPLING** |

# REPLACEMENT PARTS LIST

**Important Safety Notice:** Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

| Ref. No. | Part No. | Description |
|---|---|---|
| **T551** | **TLF15615F** | **TRANSFORMER, FLYBACK** |
| **T2401** | **ETP48EU28B** | **TRANSFORMER, AUDIO POWER** |
| **CRYSTALS/FILTERS** | | |
| X001 | TSS2077MX | CRYSTAL, OSCILLATOR |
| X101 | EFCH45MVK12N | SAW FILTER |
| X102 | EFCS4R5MW3BA | 4.5MHZ TRAP |
| X201 | EFCS4R5MS4W | FILTER 4.5MHZ BANDPASS |
| X501 | EF0A503KS41 | CRYSTAL, OSCILLATOR |
| X601 | TSS816MX | CRYSTAL 3.58MHZ OSCILLATOR |
| **OTHERS** | | |
| **M001** | **A51ADY02X** | **CRT 20"** |
| M002 | EAS12D128EG | SPEAKER, 3" X 5" 8 OHM |
| M003 | ENV56897G3 | U/V TUNER |
| M004 | EUR37234 | RECEIVER, REMOTE CONTROL |
| M005 | EUR641156 | TRANSMITTER, REMOTE CONTROL |
| M006 | TBM170179 | OVERLAY: CHNL/PWR/VOL |
| M007 | TBM170180 | OVERLAY: "MENU/CABLE TV" |
| M008 | TBM173042–1 | BADGE, PRISM |
| M009 | TBX1886601 | PUSHBUTTON: 2 USED; CABLE/TV & SPEAKERS |
| M010 | TEK17918 | DOOR, CATCH |
| M011 | TES2A20801 | SPRING, DAG GROUND |
| M012 | TJB17671 | A/V.S–VIDEO TERMINAL: 5 JACKS & S–VIDEO |
| M013 | TJB2A20601 | ANTENNA CONVERTER 75–300 OHM |
| M014 | TJC17347–1 | 1RF ANTENNA TERMINAL: COMPLETE |
| M015 | TJC6319 | FUSE HOLDER |
| M016 | TJS1A5150 | CRT SOCKET |
| M017 | TKP1757871 | GRILLE, SPEAKER: 2 USED |
| M018 | TKP1811783 | DOOR, CONTROL |
| M019 | TKP1811791 | OVERLAY: "POWER/ON–TIMER" |
| M020 | TKR27961 | FOOT, CABINET: LEFT |
| M021 | TKR27971 | FOOT, CABINET: RIGHT |
| M022 | TLC2042–3 | YOKE, CONVERGENCE |
| M023 | TMM2A30201 | WEDGE, DEFLECTION YOKE |
| M024 | TMM27513 | WASHER, RUBBER: CRT MTG. |
| M025 | TPC2A30145 | PKG. REGULAR SLTD CARTON |
| M026 | TQB2A0478 | MANUAL, OWNERS' |
| M027 | TSA120024 | ANTENNA, VHF |
| **M028** | **TSX5140X** | **AC LINE CORD** |
| M029 | TXFKU569SER | ASSY. CABINET BACK |
| M030 | TXFKY590SER | ASSY. CABINET FRONT |
| M031 | TXF3A01WCRF | ASSY. DAG GROUND |
| M032 | T8A262 | SILICONE GREASE–HEAT SINK COMPOUND |
| M033 | UR64EC866 | BATTERY COVER: TRANSMITTER |
| M034 | UR64VCS1093 | UPPER CASE: TRANSMITTER |
| M035 | UR64VCS1094 | BOTTOM CASE: TRANSMITTER |
| M036 | 0FMK014ZZ | CONVERGENCE CORRECTOR STRIP |

| Ref. No. | Part No. | Description |
|---|---|---|

## ABBREVIATION OF PART NAME AND DESCRIPTION

**RESISTOR**

| PART NAME & DESCRIPTION | | | |
|---|---|---|---|
| TYPE | | ALLOWANCE | |
| C | Carbon | F | +/– 1% |
| F | Fuse | J | +/– 5% |
| M | Metal Oxide | K | +/– 10% |
| S | Solid | M | +/– 20% |
| W | Wire Wound | G | +/– 2% |

Part No. Description

Example: ERD25TJ104 (C) 100KΩ (J) 1/4W

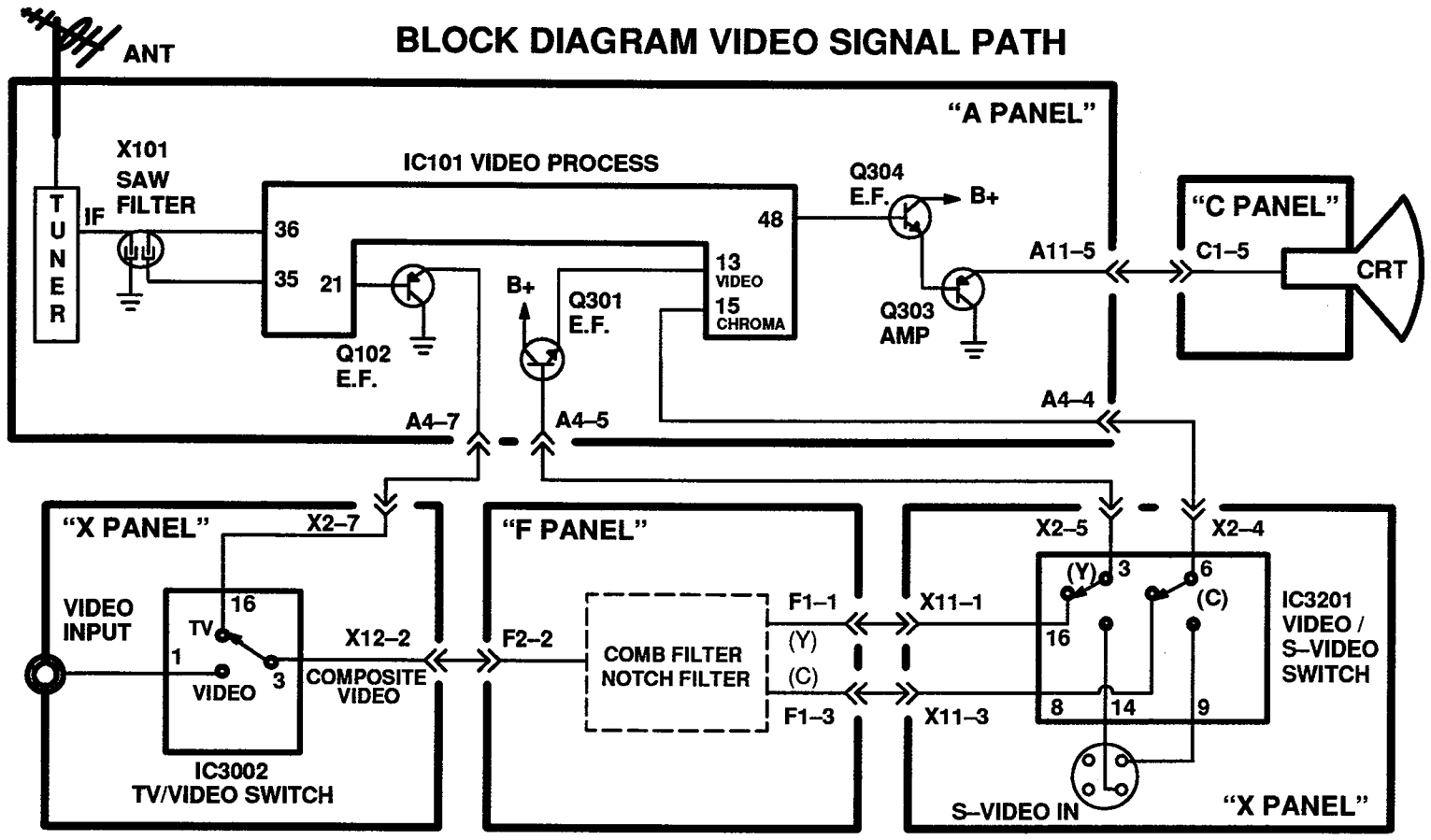
**CAPACITOR**

| PART NAME & DESCRIPTION | | | |
|---|---|---|---|
| TYPE | | ALLOWANCE | |
| C | Ceramic | C | +/– 0.25pF |
| E | Electrolytic | D | +/– 0.5pF |
| P | Polyester | F | +/– 1pF |
| S | Styrol | J | +/– 5% |
| T | Tantalum | K | +/– 10% |
| | | L | +/– 15% |
| | | M | +/– 20% |
| | | P | +100% –0% |
| | | Z | +80% –20% |

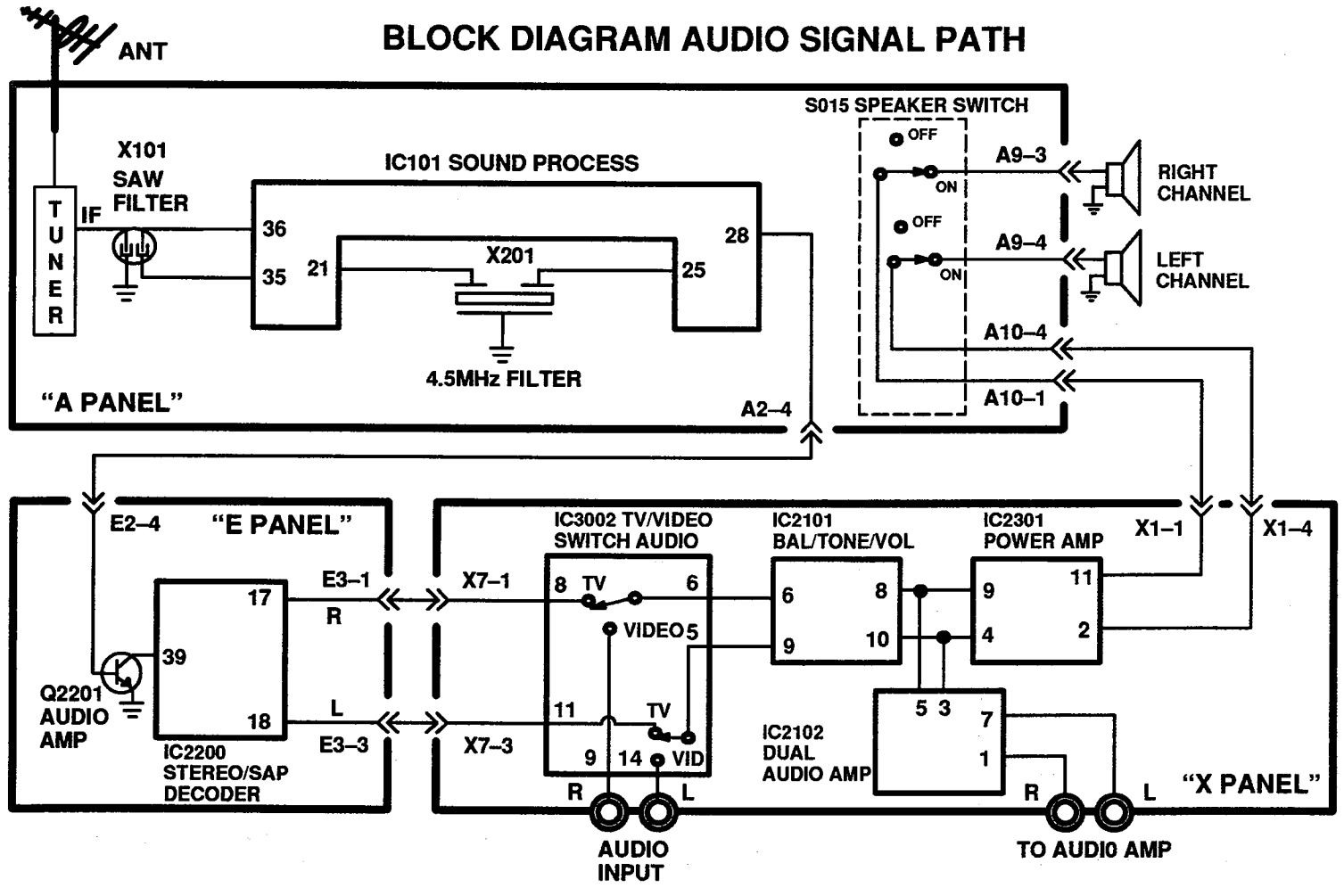
Part No. Description

Example: ECKF1H103ZF (C) 0.01µF (Z) 50V

## BLOCK DIAGRAM VIDEO SIGNAL PATH

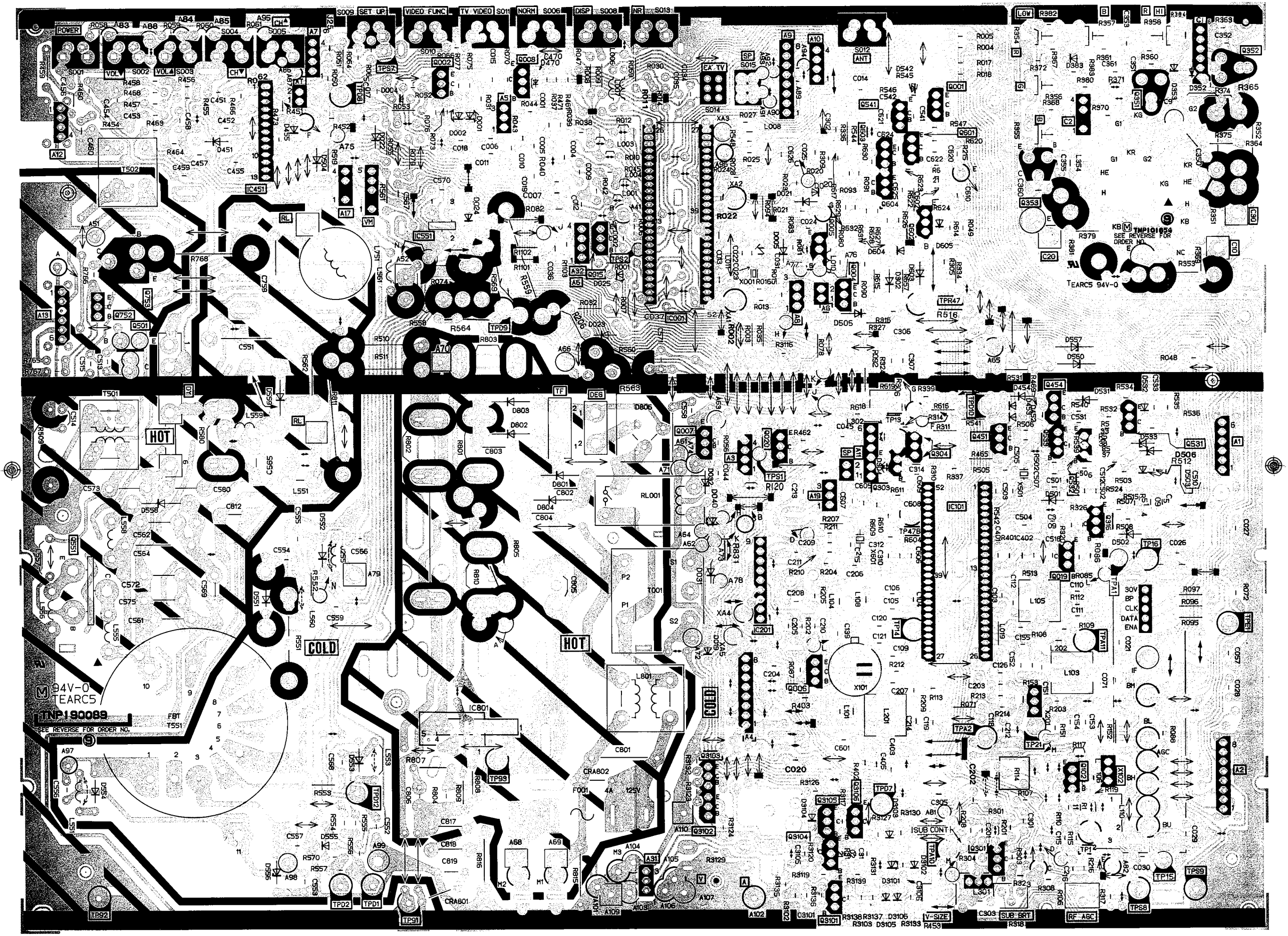



## BLOCK DIAGRAM AUDIO SIGNAL PATH



## A–Board TNP190089

## C–Board TNP101654

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